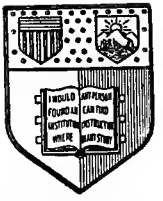
AGRICULTURE

FOR THE

COMMON SCHOOLS

BY

JAMES B. HUNNICUTT



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PREFACE.

Plow deep and on a level,
In peace and plenty revel.

That is science as well as rhyme. Pulverize the soil and get pay for your toil. The farmer feeds and clothes the millions. To help him do this with pleasure and profit is the mission of this little book. Every farmer in the South should have this helper at hand and learn to take more pride in being a farmer.

The first thing, except one, that we remember in this world, we shouldered our hoe and marched off to the cotton field. So we were taught to plow and to hoe, to reap and to mow, and always keep up with our row. Through life we have continued to study soil and plants. We have found pleasure and profit in learning how to make the soil grow good crops.

Now, in response to a thousand requests, we have tried to tell how to do this.

But if farming ever reaches the place among other callings which it should have, it will be when we have taught our children its beauty and its rank in the schoolroom. Agriculture should be taught in every school.

We have made it so simple that any teacher can use this book, even if entirely ignorant of the principles of Agriculture or the practices of farming.

The questions at the close of each chapter will help both the teacher and the student.

But in so small a space we could only be suggestive, not exhaustive. Hence the wide-awake teacher can enlarge and illustrate.

We think the student who has studied this book will see the world with different eyes.

City life has been absorbing the brain and beauty of the country. And it needs it. But we can not afford to spare so much of our young manhood and womanhood as we have been doing. We must keep the young folks on the farm

Many books have been written on Agriculture, but they are all more or less treatises on agricultural chemistry. We have avoided this channel. While we adhere strictly to scientific truth, we have used plain language. Technical terms have been left out. We have tried to write so that every child could understand. How we have succeeded we must leave you to judge. Industrial education is the demand of the day. Agriculture is the largest and most important of the industries. Heretofore it has been at the bottom. Let us now see that it is placed at the top. To do this, we must educate the farmers.

The world will respect brain. If we make ourselves the equals in intellect of those in other callings, then we will be as much respected, and not until then.

We need as much skill to grow plants as does the physician to heal the sick, or the lawyer to clear criminals.

It takes as much brain to run a four-horse farm as to run a bank or a railroad. The farmer carries *all*.

If the farmer fails
And can not buy,
Then the merchant's goods
Upon his shelf must lie.

If the farmer fails
And has nothing to sell,
Then the banker's account
Does not swell.

If the farmer fails
And has nothing to ship,
The railroad train
Makes an empty trip.

If the farmer fails
And hasn't the money he ought,
Then the lawyer's fee
Drops down a naught.

If the farmer fails
And hasn't the bills,
Then the doctor
Ceases to roll his pills.

If the farmer fails
And can not pay,
The school-teacher's account
Waits for another day.

If the farmer fails,
  As sometimes fail he must,
The world's business lags
  And the wheels of commerce rust.

But if the farmer succeeds,
  As succeed he should,
We all look happy
  And we all feel good

For upon our broad shoulders
  All the rest do lie,
And sometimes the pile
  Gets very, very high.

Success to the farmer.

JAMES B. HUNNICUTT

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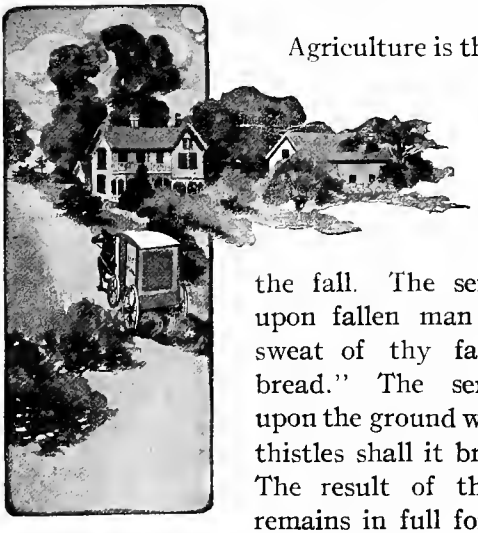
AGRICULTURE FOR THE COMMON SCHOOLS

CHAPTER I.

MAN'S CHIEF PURSUIT.



Agriculture is the noblest pursuit of man. Before he fell Adam dressed the Garden of Eden. Partaking of forbidden fruit was the cause of the fall. The sentence pronounced upon fallen man was that "in the sweat of thy face shalt thou eat bread." The sentence pronounced upon the ground was that "thorns and thistles shall it bring forth to thee." The result of these two sentences remains in full force to this day.

The evil growth is spontaneous. The good must be cultivated, and from this cultivation all the race must eat their bread. This means that we can not

live without cultivating the ground. We must destroy evil and useless plants and keep good and innocent plants. The work necessary to do this is called Agriculture, which word signifies tilling or cultivation of the field.

All other pursuits, callings and professions among men grow out of the necessities of the agriculturist, and are largely dependent upon him for their support. The farmer needed tools with which to cultivate his crops, hence the blacksmith came into being. He needed houses, and thus called for the carpenter's skill. The blacksmith and carpenter needed iron and steel; hence the miner was called for. The farmer needed schools for his children, that they might not grow up in ignorance, and thus called forth the teacher. His religious wants called for the preacher, and his legal rights demanded government and laws, and hence lawyers, judges and officers of all ranks came in due time to serve the farmer's necessities. Disease called for the physician, and increased trade called for traders and transportation, and all the mechanism of banking and commerce has sprung into existence primarily to serve the wants and wishes of the tiller of the soil.

Successive generations have multiplied these. Science, art and invention have contributed to the rapid development of society, and now we see a vast, complex civilization dependent upon mining, manufacture and agriculture for support.

Agriculture is easily the chief of these three, because we can not live without bread, and bread grows from

the ground. "The king himself is fed from the field." No amount of education, learning, science, invention, industry, or skill can do away with the necessity for cultivating the ground. The more these increase and flourish, the greater the need for the products of the farm. They only increase the number of non-producers to be clothed, fed and sustained by the cultivators of the soil. The farmer must feed himself and his family as well as all these others; so we see he is the most useful man of all. His calling, pursuit or profession is therefore the most useful of all professions. If this is true, it should be considered the most honorable, but for many reasons it is not so considered. These reasons we shall examine later on, when you will be prepared to understand them better. Most young people and many older people think it is more desirable to be a professional man, such as a physician, merchant, banker, lawyer, or the like, than to be a laboring man, and many prefer to labor at anything in the shade rather than in the sunshine. We have thus come to look upon farming as the least honorable of all pursuits. The chief reason for this is the fact that we have taught our educated children to go into other pursuits, and the uneducated, or less educated, to go to the farm.

Brain controls muscle. Men will respect brain. The pursuit or profession enjoying the highest education will be the most honored. In the past Agriculture has not been taught in the common schools. In the future we hope and expect it will be. This book will try to help bring about this change.

QUESTIONS

1. What is the noblest pursuit of man? 2. When did he begin it? 3. What caused the fall of man? 4. What sentence was pronounced upon man? 5. What sentence was pronounced upon the earth? 6. What was the result? 7. How are we to live? 8. Why is this called Agriculture? 9. Whence came other pursuits? 10. Tell how each was called for. 11. What has caused them to increase? 12. Which three pursuits form the foundation? 13. Which is the chief of these? 14. Can anything take its place? 15. What is the effect of the growth of other industries and of population? 16. What profession is the most useful, and why? 17. How does it rank? 18. How should it rank? 19. How do young people feel about it? 20. What is the result? 21. Why? 22. What rules? 23. Has Agriculture been taught in the common schools?

CHAPTER II.

AGRICULTURE AS A SCIENCE.

God has made this world by law. He has so arranged everything in it, both in the moral and physical universe, that there are no accidents. All things continue to exist by definite, fixed laws.

Science is what man knows about God's laws. Chemistry is what we know about the *laws* that control the movements and existence of the ultimate minute atoms and molecules of matter. *Physics* is what we have learned of the laws that regulate larger bodies of matter. Hence we speak of the *Science* of *Chemistry*, the *Science* of *Physics*, meaning not all that God knows about these things, but what we have learned of His laws concerning them.

The earth, or soil, was created and adapted to cause seed to germinate, or sprout, and grow under certain conditions. Seeds are so made that under certain conditions they will sprout and grow in the soil. Neither of these operations takes place by accident. Both always take place according to laws. These laws are fixed, definite and certain in their action. Seeds do not produce plants until the essential conditions are complied with. When these conditions or laws of life, one and all, are fulfilled, they produce plants and seed after their kind and then die; but when these conditions are wanting or when they are violated, the seeds

die before they have completed their work, or produce sickly plants, of little value. These conditions are laws which God has made, and by which plants grow. They are laws as definite as the laws of chemistry or of physics, or those of any other science. We know many of them as clearly and certainly as we know

IN PASTURES GREEN.

the laws of any other science. Therefore we are justified in saying that Agriculture is a science. Not only is this true, but it is the greatest of all physical sciences. All of the others are more or less related to and grow out of this science.

Chemistry is largely a science of the growth and uses of plants and soils and of the elements that enter into soil composition and plant life.

Physics is largely a knowledge of the laws that control the elements of plant life, growth and utilization.

Heat, light, electricity, moisture, winds, gaseous movements, and such, are all contributory to healthy plant growth.

Agriculture does not stop with the study of soils and plants, but has much to do with animal life and development. "All flesh is grass" and the growing, handling, care and utilization of animals is a very important part of every successful farmer's work. Bee-farming, poultry-farming, dairy-farming, cattle-growing, and many more instances, show that animal industries are a part of farm economy. The insects and birds contribute to our success or failure as they are harmful or helpful. Even microscopic life often enters largely into the account of success or failure. All the way from the microscopic to the telescopic worlds, we are much concerned. The heavens are scanned and the seasons foretold and "weather probabilities" forecast for our benefit.

Agriculture touches all nature when the interest of living man is considered. It is indeed the greatest of all sciences. No other science proposes to take the unorganized and organize it, to give life to the sleeping germ and growth to the silent dust. If it does not create, it brings us into the closest contact with the Creator. To know the laws which govern the life, health and growth of plants and animals is to know the science of Agriculture.

QUESTIONS

1 What is the subject of this chapter? 2 How has God made everything? 3 What is a science? 4 What is chemistry? 5 What is physics? 6 What do we mean by the science of each? 7 What is

the relation of soil to seed? 8. What of seed to soil? 9. How do they act toward each other? 10. What are the laws of seed life? 11. Are they certain? 12. May we know them? 13. What do we conclude? 14. How does Agriculture rank as a science? 15. What of chemistry and Agriculture? 16. What of physics and Agriculture? 17. Does Agriculture concern itself with animal life? 18. Why? 19. Does it relate to insects and birds? 20. What about microscopic life? 21. How far does the science of Agriculture extend? 22. What does it propose?

CHAPTER III.

SOMETHING OF THE HISTORY OF AGRICULTURE.

We can not give space for anything like a complete history, nor can we get satisfactory information if we had the room. Agriculture has received very little attention from historians. We get glimpses here and there which throw some light upon its condition through all the ages past.

In the times of which Moses wrote, some enormous crops were grown in Egypt, but very little is said about the methods used. It seems to have been the exceeding richness of the soil that lay along the Nile, rather than the methods of cultivation. But we are not at liberty to conclude that the grapes of Eshcol were a wild growth. In after years the children of Israel made the land of Canaan yield such abundant crops of all kinds that we must believe that their methods of culture were not very crude. That country will not to-day support one tenth of the population which then lived in great luxury on it.

The Romans gave great attention to their farms. Many of their best statesmen and orators prided themselves upon their skill in conducting their farms and the beauty of their country homes. Virgil gives a minute description of their fruit farms.

But we find the oldest nations, like the Chinese, still pursuing very crude methods of farming. They use the poorest of implements and exhibit but little skill and science in the matter. So of many other old countries, which pride themselves in the fact of their history covering many centuries.

We feel justified in saying that the people who have farmed best have been the strongest people, and have had most influence upon the world's history and growth in all that is good. But the Science of Agriculture is a new science. Little seems to have been known of soil adaption to plant production until comparatively recent years. The study of the laws of plant germination and growth is still more recent. It has been hardly half a century since this study took definite shape and systematic form. The application of plant analysis to the products of the farm, and thereby finding the wants of plants and how they are to be supplied, has wrought a revolution in farming.

We no longer grow plants as if it were by accident. We may now know what any plant wants for breakfast, and how it will have it served. We know many of the laws which regulate plant life.

Since we have entered upon this new era of farming, we can teach with certainty how to succeed in many lines of Agriculture.

England, Germany, France, the United States and all civilized nations have established schools, experiment stations and colleges for the instruction of their farmers in this great and useful science.

Our government has appropriated money to maintain one such station and college in each State and Territory. Able faculties are maintained in each of these colleges to teach the young men of the country to farm scientifically.

Many books are written annually and numerous journals published to help spread this valuable knowledge among those who can not go to the schools and colleges, and perhaps in a few years the science and art of Agriculture will be taught to some extent in every public school in this nation. They are already so taught in England, France and Canada. This little book hopes to assist in this work.

So we see this science, so long neglected or little known, after having slumbered for nearly six thousand years, now, at the dawn of the last century of the six thousand years, coming right to the front and claiming to be equal in importance to any.

The chemistry side of Agriculture has already demanded and received serious attention, and books on that subject flood the market. What is needed now is a few good books, written by men of large experience in farming, on the practical side of this great subject.

The laws are known and the theories are numerous and good. We need to have the theory put into practice, so as to show its correctness and value.

QUESTIONS.

1. What does this chapter discuss? 2. Is the history complete? 3 What do we learn from Moses? 4. What about Canaan under the Israelites? 5. What of its present condition? 6. What of Roman

farming? 7. What of China and other old countries? 8. What may we say? 9. Is the science old? 10. How far back does plant study go? 11. What has this study wrought? 12. What do we know of it? 13. What can we teach? 14. What have civilized nations done for it? 15. What has the United States done? 16. What of books? 17. What are colleges and schools doing? 18. What is the present condition of the science of Agriculture? 19. What is chemistry doing? 20. What do we need?

CHAPTER IV.

THE SOIL.

Having considered the general subject in its relation to other sciences, and proven, as we think, the right of Agriculture to be called a science, and given a very brief outline of its history, we will take up the subject itself.

The first thing in fact and importance is the soil. This is the farmer's capital. He can do no business at all without it. If he has no soil, he can do no farming. If he has a fair quality of soil, he can do fairly good farming. If he has a good, rich soil, he can farm with pleasure and profit. The soil is the foundation. Without it he can not build at all. With it he may build all kinds of failures or successes, as he works with intelligence or ignorance. What, then, is the soil? Where does it begin? Where does it end? What is it made of? These and many other questions must be answered before the farmer will know exactly how to proceed.

The soil is the top of the earth. It has no fixed depth, color or fertility. All of these vary in different places, and may be made to vary at any place. We speak of soil and subsoil as though they were very different. This is not always the case. We generally call that part of the earth soil which is more or less loose and colored. Generally this color is a

little darker than the earth below. This coloring has been given to the soil by the rotting of vegetable matter. It is not a necessary quality of soil, but a deep dark color generally shows that the soil is ready to make large crops. We commonly say it is rich. The looseness is caused, in forest lands, by the roots. The living roots have forced the particles apart. The dead roots have rotted and left holes. Dead and rotted leaves and branches have helped to do the same, and numerous worms and insects have also aided in the work. In the cultivated fields the looseness has been caused by plows, harrows, decaying roots, and similar work by worms and insects, and the parts of harvested crops which are left in the fields also give looseness and color to the soil.

There is no fixed line between soil and subsoil. The subsoil begins at the bottom of the soil, whether that be deep or shallow. These terms are relative, not absolute. When any part of the earth's crust or surface has become loose and ready to give up its plant food, that part is soil. Any part below which is hard and holds its plant food in a condition in which plants can not readily use it, is called subsoil. Sometimes we find the subsoil at the surface. This is seen on the hillsides where the rains have washed the soil away. The action of air, sunshine, heat, cold, and moisture will soon turn the exposed subsoil into serviceable soil.

Not only do depth and fertility differ at different places, but they may be made to differ greatly at any given place.

The soil on hillsides is generally shallow, because the looser parts are readily carried away by winds and rains. Such soil is apt to be poor also, because the finer parts are the richer parts, and as they are taken away the soil is left poorer. Exactly the reverse is the case in low places, in the upland fields, and in the bottom lands along the streams. Water and winds have been for ages depositing the finer particles, taken from the hills, in these valleys until they are very rich. Sometimes the soils in such places are several feet deep.

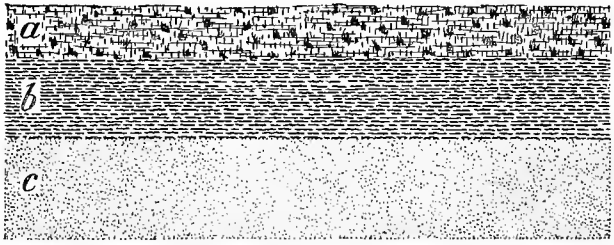
The annual overflow of the Nile deposited the soil brought from the hills and mountains of interior Africa upon the sands of Egypt, and thus made the soil very rich. These plains have produced enormous crops of grain since the days of Joseph, and continue to do so still. The Mississippi does a similar work in our own country. The soil along the basin through which this "Father of Waters" flows is of unknown depth and inexhaustible fertility.

So, you see, we have soils of all depths, from the Mississippi Delta to the naked hill—from a hundred feet to nothing.

The soil was made from the subsoil, and the same agencies which have done this work in the past are still active. We can help them in this work.

By studying any cultivated field, we will find that just below the soil is a hard subsoil. This is the result of the pressure of the mule's foot, the man's foot, and the plow's foot upon the subsoil. This is very often too wet, when the top soil is not too wet. When we stir

earth and water together, we make mud. When we dry the mud it becomes more or less hard. By going over the fields very often, we have done the same to the subsoil, and as it has dried behind us it became harder and harder. It is very hard on many farms. You can feel the plow grate upon it as you go over it. This hard layer is from four to eight inches deep, according to the age of the field, kind of subsoil, and wetness or dryness when plowed over. It is called



a—SOIL.
b—HARDPAN.
c—POROUS EARTH BELOW.

"hardpan." In many places it is so hard and close that water can hardly pass through it, but beneath it the earth is more or less porous.

This hardpan very greatly affects the yield of the ground. It is all-important for the farmer to understand its nature, the cause of it, the effect of it, and how to get rid of it. If a farmer plows six inches deep, his soil will be six inches deep. If now he takes a larger plow or runs twice in the same furrow and goes two inches deeper, his soil will be made deeper. If he goes four inches, his soil will be made still deeper

and his hardpan thinner. If he goes entirely through the hardpan and reaches the porous earth, his soil will be very deep. The six inches of subsoil will make more than six inches of soil. If a cubic foot of rock be broken into a thousand particles, the pieces can not be put into a cubic foot of space. It will occupy much more space, because of the space between the fragments filled with air.

Now, this will be true of the hardpan. When broken by the plow, and made still finer by the harrow, and still finer by the frost, gases, air, and water, there will be from fourteen to eighteen inches of soil, instead of four or six. Not only will the depth of the soil be greatly increased, but the fertility will also be greatly increased. It is a law, which we will explain further on, that, other things being equal, the finer the particles of any soil, the more fertile the soil.

We then see that soil is the decomposed surface of the earth. The deeper the decomposition, the deeper the soil. The depth of this decomposition can be greatly increased by good work or deep plowing, and greatly decreased by bad plowing or stirring the earth when too wet. In other words, the farmer can make or unmake his soil.

QUESTIONS.

1. Of what does this chapter treat? 2. What have we considered? 3. What is the farmer's capital? 4. What can he do with it? 5 What should he know about it? 6. What is true of soil? 7 What is commonly called soil? 8. What is said about the color of the soil? 9. What makes new soil loose? 10. What makes old soil loose? 11. Where does soil cease and subsoil begin? 12. Is subsoil ever at the surface? 13. What does nature then do, and how? 14 Are

depth and fertility uniform? 15. What of hillside soils, and why? 16. What of lowland soils? 17. What of the Nile soil? 18. What of the Mississippi Valley? 19. How deep are soils? 20. From what are they made? 21. What do we find in most fields? 22. What has made it? 23. How deep is it? 24. What do we call it? 25. What effect has it upon crops? 26. Is it important to know this? 27. Explain the figure, and how to proceed. 28. Does hard or loose soil occupy the most space? 29. How deep is the soil when hardpan is broken? 30. What is the effect on fertility? 31. What is the law? 32. What have we found to be true?

CHAPTER V.

COMPOSITION AND KINDS OF SOIL.

Soils differ somewhat in their composition. Some contain a very large per cent. of sand and are called sandy soils. Such soils have about seventy per cent. sand.

Clay soils have about the same per cent. of clay. Soils which have about one-half clay and one-half sand are called loamy soils. When they have more sand than clay, about sixty per cent. sand and forty per cent. clay, they are called sandy loams. If they have more clay, about sixty per cent., and less sand, about forty per cent., they are called clay loams. We find, then, sandy, clayey and loamy soils, all varying with the relative quantities of sand and clay entering into their composition. This classification is based entirely upon the mechanical structure of the soil. Sand is the name given to coarse particles and clay the name given to fine particles.

Soils also differ in color. Hence we have light, dark, red and black soils, and all shades between them. Again, we have names given on account of the power to produce vegetation. We have poor soils, which will not yield large crops, and rich soils, which will yield large crops, and barren soils, which will not yield any crops. There are many other causes which give special

names, but it is not necessary here to give all these, as they will generally explain themselves.

All soils are composed of different substances. Some of these are aluminum, quartz, feldspar, iron, potash, lime, phosphoric acid, magnesia, soda, and humus. There are also present in all soils water and gases, such as oxygen, hydrogen, nitrogen, and carbon, and these, as we shall see, exert a powerful influence upon the soil.

Humus is not an original element. It is thought to be the result of decomposition of vegetable matter, but it is so important that we have thought it best to give it a place in the list. A soil having no humus will not produce vegetable growth worth anything, whether it be sand, clay or loam.

Many soils are somewhat sandy on top and have a stiff red clay below. Such soils are apt to be good and capable of indefinite improvement, but if the subsoil be a white sand or a pipe clay, the soil is generally poor and apt to remain so.

QUESTIONS.

1 What do we now study? 2. What is a sandy soil? 3. What is a clay soil? 4. What is a sandy loam? 5. What is a clayey loam? 6 On what is the difference based? 7. How else do soils differ? 8. What are fertile soils? 9 What are poor soils? 10 What are barren soils? 11. What substances compose the soil? 12. What is humus? 13. What is the effect of the subsoil?

CHAPTER VI.

USES OF THE SOIL.

The soil serves to hold the plant up against the wind and its own weight. To do this, it must furnish a good root bed. If the soil be too compact, the tender rootlets can not find their way through. If the soil be too loose, it will not hold the heavy tops of the plants against storms and accidents. Thus we see that the soil should be full of pores but not too loose. Sandy soils are generally quite loose. The particles are not held together by cohesive attraction. Hence tender roots grow very rapidly in sandy soils. Clayey soils are more compact. The sponge-like tips of young roots can not get between the particles so easily. This is why transplanted vegetables grow quicker in sandy soils. For the same reason sand or sandy soils are better for rooting cuttings of all kinds.

Many plants desire to strike their roots deep down in the earth. Trees and heavy-topped plants of all sorts find this necessary. Hence the porosity of the soil must extend to great depth to accomplish this end.

The soil not only holds the plant up, but in a very important sense feeds it. It is true that a very small part of the plant is taken directly from the soil, but that small part is the very life of the plant. If it is not present, the other parts can not do their work. Much of the food furnished to plants from the air and

other sources must be worked over in the earth before the plant can use it.

So we see that soil is not only a root bed but also a food bed and a workshop for plant growth. Neither of these latter purposes can be secured if the soil be too compact. Circulation is the law of plant life, and for circulation there must be room. The mere mechanical texture of the soil, then, is a matter of great importance.

Through the soil comes the sap. Hence the soil must be also a water bed. Here must be received, kept and furnished an ample supply of water. This supply must not only be sufficient to give the sap, or circulating matter in the plant, but also to dissolve and hold in solution an abundant quantity of plant food ready for use when called for. Nearly three-fourths of living vegetation is water. About ninety-seven per cent. of the solid part is from the air, and only about three per cent. from the soil. In many plants, such as the watermelon, only about one per cent. comes directly from the ground, but nearly all that makes up the plant comes through the roots. Hence a thorough knowledge of the soil is indispensable.

We learn the above facts in the following simple way: We take a quantity of vegetable matter and dry it thoroughly. We find that a large part of its weight is gone. We conclude that this was water, and that we have reduced it to a state of vapor. Proceeding a step further and burning the remaining dry matter, we find that a considerable proportion of it, about ninety-seven per cent., has disappeared.

What has become of it? It has simply returned to the air, whence it came. We find, then, a residue of about three per cent., or three pounds out of one hundred pounds of dry matter, that will not burn. This we call ash. It is found to be earthy matter, and constitutes all that the soil had given directly to the building up of the plant.

Now, we proceed with analysis and find that this ash, or earthy matter, is composed of about fourteen substances: iron, soda, sulphur, lime, potash, phosphoric acid, magnesia, and others that need not be named. These fourteen substances are everywhere present in all soils, and always found in the ashes of all plants.

Eleven of them are in such small quantities in the ashes, and are in such universal distribution in sufficient quantities in all soils, that we need not give further attention to them here. Three of them are found in large quantities in the ashes of most of our farm crops, and are not always in sufficient quantities in all soils. These are found to be absolutely necessary for the healthy growth of all our crops. Hence it becomes a matter of great importance to the farmer to know about potash, phosphoric acid and lime. Without these he can not farm. They must be present and in available form, or he can grow no crops.

Now, the question is sure to arise in the inquiring mind, "If these are needed in so small a quantity, why can we not do without them entirely?" Now, the largest and healthiest person has only a small quantity of iron in his blood, but if he had none at all

he must die. You see a well proportioned man look pale and listless; with appetite failing, and unable to digest or assimilate what he may be induced to eat. Broken in health and ambition, he seeks the aid of a physician, who examines him and tells him that his blood is wanting in iron, but he does not send him to the blacksmith to obtain it. He prescribes a tincture of iron, with perhaps a grain of that metal in an ounce of the fluid. The patient takes a few drops of this tincture three times a day; his color assumes a healthier hue; appetite and digestion improve; strength, vigor, manhood and ambition all return at the magic command of this little trace of iron in the tincture.

a—PLANT FROM SHALLOW SOIL.
b—PLANT FROM DEEP SOIL.

What the iron does for man, potash, phosphoric acid and lime, do for the plant. We prove this in giving a plant all the necessaries of life and growth except potash, and we see it refuse to grow, and finally it will sicken and die. The same is true of phosphoric acid. The plant may have plenty of potash and lime, but without the phosphoric acid it will refuse to grow. So it may have plenty of potash and phosphoric acid, but, if the lime be wanting, death results. We thus see the important part the soil serves in the vegetable kingdom.

It furnishes a root bed for holding plants and a food bed for feeding them. It furnishes a water bed for sustaining the growth, and a laboratory for the preparation of all plant food. Finally, it furnishes the health-sustaining foods without which plant life would be impossible.

It is alone through the soil that the farmer is able to control, modify, check, or help plant growth.

QUESTIONS.

1. What is the subject of this chapter? 2. What is the first use of soil? 3. How do sandy and clayey soils compare? 4. Which is better for transplanting? 5. Should soil be deep, and why? 6. What is the next use of the soil? 7. Does the soil prepare the food? 8. What condition helps? 9. Where do plants get water? 10. Why should this be abundant? 11. What proportion of vegetation is water? 12. How do we learn these facts? 13. Where does the hard part go when burned? 14. What part comes from the earth? 15. How do we proceed, and what do we find? 16. What is true of eleven of these substances? 17. What of the other three? 18. Can we do without them? 19. Give illustration. 20. How do we prove their value? 21. Can plants grow without either? 22. Sum up soil uses.

CHAPTER VII.

THE SOIL AS A WORKSHOP.

In the preceding chapter we have pointed out some of the most important uses of the soil in farming. One of these needs fuller treatment. We can not know too much about the soil as a workshop for plant-building.

"The earth that drinketh the rain that falleth oft upon it" stores away the rain water. The soil also drinks in the heat and light of the sunshine. These, together with the atmosphere, mingle and circulate and form new and wonderful combinations, make and unmake substances. They form acids that have very great dissolving power.

Most of the elements of plant growth are abundant in the earth, but they are insoluble. Plants can not use them as solids; hence the need of these acids. The potash, phosphoric acid, and lime must be fed to plants in water. It is thought that the carbon, which is the largest part of the wood of trees and stems of plants, must pass from the atmosphere into the earth, and through the roots into the plant. The nitrogen must come from the air also and pass through similar changes in the soil. All manures, whether animal, chemical, or vegetable, must be decomposed in the soil, become soluble and feed the plant from the soil through the sap. Indeed,

the sap is a peculiar and wonderful product of the soil workshop. In this workshop many things are dissolved that our most powerful acids do not dissolve. Here it is that inorganic matter takes an organic form. That which was dead becomes alive. The wonders of the vegetable kingdom are born here. Here are mixed the preparations that render possible all the glorious shades and tints of the flower world. Here are kept the secrets that evolve the subtle aromas that regale the palace and the peasant's hut. Here the virulent, deadly poisons and the luscious fruits that charm the eye, please the taste, and invigorate the stomach are made from the selfsame material. The orange and the deadly nightshade spring up and grow side by side, fed from the same lump of soil.

Wonderful, indeed, are the mysteries of this great workshop. From it we were made, and to it we return. It is our mother and our final repose. To this workshop the farmer commits his seed. From it he receives his stores of food and raiment, his commerce and his wealth. These wonderful results are not brought about by accident: they are the result of definite, unchangeable laws. These laws can not operate if the soil is badly treated. It must be kept porous and warm, and prevented from washing and leaching, if we expect its work to be well done. The farmer should know his soil and the laws which govern its work.

The value of any soil to the farmer will depend largely upon its deepness, its looseness, its fineness, and the distribution of water in it. A soil will be fertile

or poor, not simply on account of the elements of plant food it contains, but on account of the condition of that food. The quantity of plant food may be abundant, and because it is insoluble the soil will be poor. Indeed, we find that plant food is abundant in all soils, but it is not soluble in many places, and such places are poor.

QUESTIONS.

1 How do we consider soil? 2. Why? 3. What materials does it gather? 4. Why do they need working over? 5. Is this true of earthy and atmospheric food? 6. Is it true of all food? 7. What carries all these where they are needed? 8. What wonders take place in this shop? 9. What separates poison and food? 10. What is our relation to this work? 11. What does soil do for seed? 12. Are these results accidental? 13. Can we help the soil? 14. What controls value of soil? 15. What must be the condition of plant food?

CHAPTER VIII.

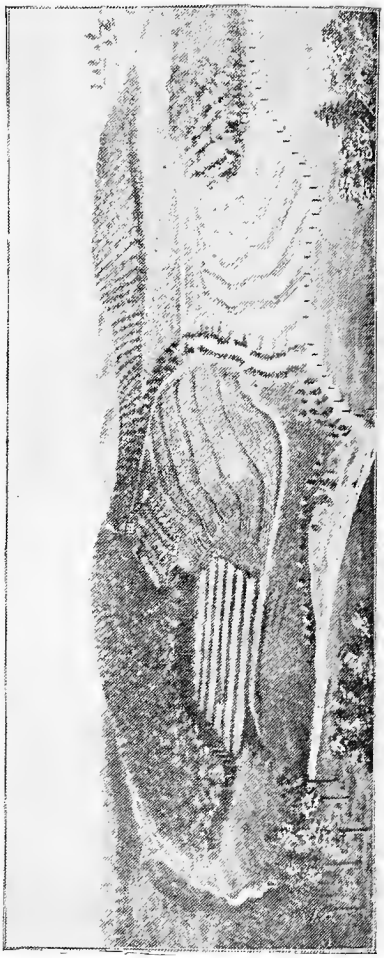
PRESERVATION AND IMPROVEMENT OF THE SOIL.

We find part of the land in original or second growth. The first has never been cultivated. The second has been cultivated until more or less exhausted. "Worn out" is a common expression used to describe it. Then it has been left uncultivated until another growth of trees has come upon it. Another part of the farming lands are "worn out," badly washed, and almost useless for farming purposes. We have land of all grades between these—good, bad and indifferent soils.

How shall we manage each of these varieties so as to get the largest yields at the least expense of labor and money?

First, we will take the forest land. To use this for growing crops of such sorts as we cultivate, we must first remove the crop of trees. The usual way is to cut them down with axes, leaving the stumps to rot at their leisure. This is not the best way. Stumps are in the way of good farming, and take up much room, sometimes nearly one-third of the space. The best improved implements are useless in stumpy fields. It is therefore important to remove the stumps, but it is quite expensive to do so. It is much easier to dig up or blow up a tree than a stump after the tree is cut. The heavy top helps to pull out the roots. So we advise

HOW THE FARM IS LOST—SMALL GULLIES MAKE LARGE ONES.



HOW THE FARM IS RETAINED—BY DEEP PLOWING AND LEVELING.

taking the tree out root and branch. The cheapest way to do this is by the use of dynamite cartridges. One side of most trees has a missing root. Into this vacancy drive a crowbar, made for this work, two or three feet deep under the tree, and into this hole place dynamite, and the tree is easily and cheaply blown up. There is no danger in the use of this method.

The whole body of most trees can be used so as to pay for the clearing of the land, and leave a good profit. Very many forest trees make lumber that is salable, and the parts unfit for sawing make good fire wood.

Economy should begin here and continue through all farm work. Whatever will burn will rot. Whatever will rot will enrich the soil. Therefore, nothing should ever be burned on a farm. This syllogism does not overstate the facts. Matter that has once been a vegetable will help to make a plant grow again. Rotting vegetable matter is too valuable to lose. We should not burn off the new ground, then, as is the custom. Let the twigs and leaves rot. This may require one or two years' delay, but the money gained is worth more than the time lost. Take five years from the time you begin to clear, and the land, where the time is given for all the waste to rot and be plowed in, will yield more than if the usual burning off and immediate planting plan had been followed. This will be true if we should lose two years and make only three crops, with the trash all rotted in, against five crops on the burned-off land.

Fire is a great enemy to the farm, and has done almost as much damage as washing. Millions of good

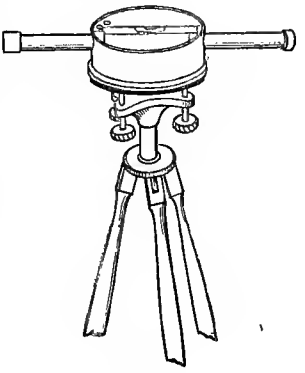
trees have been destroyed by fire. On many farms the timber was worth much more than the land cost. If this method of clearing is not adopted and the stumps are left, they should not be permitted to stay many years. They occupy too much room and prevent the use of good tools. This is not all the damage. Every stump is like a little housetop, starting the water to wash the land. When they are taken out, they leave a deep, loose place, which helps greatly to hold all the rain water and thus prevent washing. These stumps make excellent fire wood, worth the cost of taking them up. Good terracing or level plowing can not be well done in stumpy fields. If the land be rolling or hilly, this is very important, but of this we will speak more fully in considering the worn-out land.

How did the soil become worn out? In very few cases can soil be exhausted by growing the plant food out of it. On the other hand, it is almost always true that the larger crops you make land yield this season, the larger still it will yield next year. Soil is generally ruined by washing. The soil which contained the soluble plant food has been carried away by the rains. If this be true, then the first thing to do to begin restoring such lands to fertility is clearly shown to be—*stop the washing.* This can be done by plowing deep and on a level. We sometimes put it this way:—

> Plow deep and on a level,
> And in peace and plenty revel.

Plow deep enough to break the hardpan. Then, by plowing on a level across the path of the water that is

trying to make a gully, you will soon be able to stop all washing where it has begun, and to keep it from beginning in other fields. This can be successfully done in all rains except waterspouts or cloudbursts.



A LEVEL

The hardpan is generally the first cause of washing. If the soil is porous, the water will sink rapidly and not be apt to wash. Each square yard of soil will hold the water that falls upon that square yard, if no other gets upon it. The theory of level plowing is to keep all water where it falls, and thus prevent any gathering from any other places. To do this we take a spirit level and run some guide rows to plow by. It is generally found sufficient to have these guide rows about every three feet of perpendicular fall in the fields. They should be run exactly level. No fall should be given anywhere. The idea is to keep the water where it falls. Never let it collect anywhere.

We do not need broad, high banks called levels, nor do we need to terrace the land from one level to another. All that is needed is to plow by the guide rows, and to keep the guide rows to plow by. This saves the trouble of running them again. These broad, high banks of earth we see in so many fields are not only useless but harmful. We lose that much land. They furnish beds for the growth of all sorts of noxious

weeds and brambles, which fill the fields with millions of seed, to be killed the next year. If from any cause the water should ever collect against them to any considerable depth, they are apt to break and cause damage. The object is to prevent water from collecting, not to hold it after it has collected.

After all, the deep plowing is the most important thing. The leveling is only designed to help the deep plowing hold the water. Many seem to think that the leveling is the principal thing and the deep plowing of less importance. Here is the foundation of good farming: First, make a deep soil; second, keep a deep soil.

This is not all of good farming, but there can be no good farming for an appreciable time without it. Perhaps we shall say a great deal more about keeping a good soil later on, when we can more readily grasp the higher secrets of soil fertility.

One word here, which is important enough to repeat over and over: *Never stir your soil when it is wet.* If you do, when it dries you will have sun-dried brickbats instead of productive soil. These clods are worse than useless to plants, even though they be as small as number seven bird shot.

QUESTIONS.

1. What is the subject of this chapter? 2. How do we find most land? 3. How the other part? 4 What must we do with the forest? 5. How is this usually done? 6. Is this best? 7. Why not? 8. Shall we take up trees or stumps? 9. How can we do this cheaply? 10. Is dynamiting dangerous or expensive? 11. Why should we not burn vegetation? 12. Does this apply to new clearings? 13. Will this cause loss? 14. What will be the result in five years? 15. Has fire been a friend to the farmer? 16. Shall stumps remain? 17 What harm do they cause? 18. How does removing them help? 19. How do soils get poor? 20. What is the first step to improvement? 21. How can we stop washing? 22. Can we make soil hold all the water? 23. Where does washing begin? 24. What is true of each square yard? 25. What is the object of level plowing? 26. How is it done? 27. Do we need high levels? 28. Why not? 29. What is most important? 30. Do we need deep soil? 31. Should we ever plow wet land?

CHAPTER IX.

OTHER POINTS ABOUT SOIL.

REMOVING STONES.

In many fields are to be found numerous stones. These very greatly hinder good farming, so it is well to know the best way to dispose of them. We can not use many of the best farm tools in stony ground, for this condition greatly hinders the best use of any tools. On some farms they are so numerous as to justify building fences with them, but this is not desirable on a great many farms. Many farmers have piled them in heaps, but this is found objectionable. The piles are continually in the way and take up much valuable room. Besides this, they furnish hiding places for rats, moles, and other pests, and rooting places for numerous weeds and vegetables which are troublesome on the farm.

Where there are washes already in the fields, the stones may be put into the gullies. But perhaps the most useful and least hurtful way to get rid of them will be found to be as follows:

When you have run your levels or guide rows, instead of placing your stones on top of these, as has been the custom with many farmers, place them under these levels. Take a two-horse plow and throw out as deep a ditch as you can, then run a subsoil plow in this ditch and throw out the earth

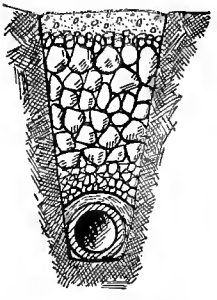
with hand shovels until it is deep enough to admit the stones and leave them at such safe depth that the plows will never reach them. Then place the stones in these ditches and cover them. This plan has many advantages. You get the rocks moved with less labor and cost than by any other method. You have an underdrain which is of great value. You get rid of the weed and brier beds which they make if placed on top. You can cultivate right over them, and they will prevent the land from washing more surely than if piled on top.

This is the cheapest as well as the best way to remove stones from the fields. It costs less to get rid of a stone in this way than it does to work it for one season.

DRAINAGE.

Some soils are too wet, because of the fact that no suitable outlet is provided for the surplus water that falls during winter. There is not enough water to prevent cultivation, but there is too much for the health of the plant roots. The subsoil is too firm to let the water sink out of the way, or the land lies so that there is a sort of basin formed. Such fields need to be underdrained. This is done by carefully surveying the land, and placing terra cotta pipe, burned for this purpose, about three feet below the surface, so arranged that all the lines empty into some outlet low enough to carry the surplus water away. These lines of pipe should be from thirty to fifty feet apart. The soil will rapidly become

dry enough for culture, and the locked-up stores of plant food will be available, and fields which were the least productive will become the most productive of all the farm. This wonderful change will be caused by letting the sunshine warm up the soil, and the air and water circulate freely where the standing water was before. The roots and plants will follow this circulation, and find food and life where there was poison and death before. The change is often like magic. It is marvelous in our eyes. Very much more of our land needs this treatment than is generally believed. It is thought by many that it would pay to underdrain all of our fields, but we are inclined to think that deep plowing will answer in many places. But this deep plowing must be done often and thoroughly, and followed by repeated harrowings.



A DRAIN DITCH.

All the vegetable matter possible should be plowed in.

GREEN MANURING.

Green manuring, as a help to restoring worn-out lands, and as a means of preserving a high state of fertility in good lands, is worthy of some mention. The use of crops which gather and store nitrogen is very important. Clover is the best of these. Common field peas are almost as good, and for most farmers more convenient. This subject will come more properly under the head of manuring land.

Experience seems to show that it is the growing of these crops and the decaying of their roots that does the best work. Turning under green crops has not been found to pay as it was thought it would.

QUESTIONS.

1. Of what does this chapter treat? 2. Why should we remove stones? 3. How shall we use them? 4. Why not heap them? 5. What way is suggested to dispose of them? 6. Explain how. 7. What are the advantages? 8. Is it cheaper to work a stone than to move it? 9. Why should we drain some soils? 10. How is this best done? 11. What are the advantages of underdrains? 12. What causes the improvement? 13. What is the effect upon plant roots? 14. What may sometimes do as well? 15. What is the object of green manuring? 16. What plants are suitable for this purpose? 17 What is the real benefit derived?

CHAPTER X.

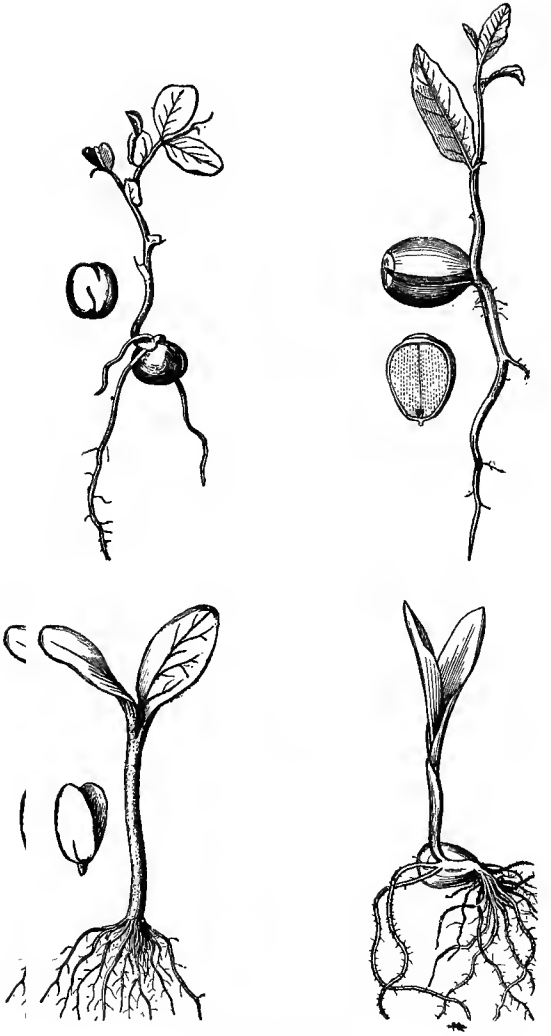
PLANTS: HOW THEY GROW.

As the soil is the farmer's capital, so plants and animals are his stock in trade. We will now give attention to plants. We do not propose to discuss the entire vegetable kingdom, but such plants as the farmer finds profitable to plant and cultivate, and some that he must destroy. The arrangements of nature are such that the soil is adapted to the growth of vegetation, and vegetables are so constituted that it suits them to grow in the soil. The soil contains just the right sort of food for plant growth, and plants need just what the soil has to give. They are in a very important sense the counterparts of each other. The soil produces the plants, and the plants die and rot and feed the soil.

THE GERMINATION OF SEEDS.

Seeds have an outer shell or covering to protect them from the weather. This is generally hard or tough. Next is a lot of food stored up to feed the young plant until the roots can grow. Lastly, inside and well protected is the little embryo or germ of future life. This is the real seed.

We take any seed, as for instance the common garden bean, and place it in suitable soil in the spring of the year. Soon the sunshine warms the water in the soil, and it soaks through the tough skin of the bean



GROWING PLANTS.

and wets the starchy substance inside and changes it to sugar. This vegetable substance—sugar—enters the little germ, wakes it up and starts it to growing. The stem end starts upward to seek the light. The root end starts downward to seek darkness, water and food. These never make a mistake and start the wrong way. They know what is right and they do it. Here we see indications of design in the plant kingdom. The two lobes of the seed are brought up through the earth and make more or less perfect leaves, while they give their store of food to the stem which pushes them up. The little feathery bud between them, called the plumule, then grows on to form more leaves and stems and branches and blooms, and seeds like those they grew from. But how was all this done? Let us see.

HOW PLANTS GROW.

When the stem started upward, the root started downward. This immediately began to branch and form other roots. Each of these took a different direction. Soon the little plant was strongly rooted in the ground. Each rootlet carries a little soft point, called a spongiole, on the tip, and through this constantly absorbs or drinks in the water from the earth. Soon thousands of small hair-like roots fill all the soil, and together they take a great quantity of water. This water we call sap. It runs up and down through the cell pores of the plant. This water carries with it the food offered by the soil. These minute spongioles do not take in anything solid. They only take in that which is dissolved in the water. This water goes rapidly

up through the stems to the leaves. Here it meets the chlorophyll, a green substance formed by the action of the sunshine, which has the power of working it over, selecting such as the plant needs, and throwing off into the air that which it does not need. This waste is thrown off through thousands of little mouths, generally on the under side of the leaves. The part suited to the growth of the plant is returned, after being worked over in the leaves, and flowing down through the branches and stems deposits the right food just where it is needed to build up the different parts of the plant. What is needed for bark is left to make bark; what is needed for wood is left to make wood; that needed for the flowers is sent to the flower bud; that needed for the seed is sent to make seed. No mistakes are made in this wonderful workshop. The scarlet needed for the crimson hue of the rose bloom is not sent to the leaves. The delightful odors needed to give fragrance to the orange blossom are never sent into the roots.

A SPROUTING SEED.

The earthy matter, potash, phosphoric acid, lime, sulphur, and such like, must be in the water of the soil, dissolved, so that it becomes part of the soil water. The carbon, nitrogen, ammonia, and other atmospheric food must go through the same channel. First dissolved in the earth or soil water, they enter the roots and are carried up by the sap circulation into the leaves. Then they are worked over, assorted, recombined, and sent to build up the rough bark or to produce the

CORN STALKS.

subtle aroma of the gaudy-colored flower. Essentially the same processes are gone through with in building the tiniest violet and the brawny oak.

The sample we selected as a type belongs to the class of plants called exogens, or outside growers, because they build themselves by constantly putting on new growth on the outside, between the bark and the wood.

The other class we call endogens, or inside growers, because they build themselves entirely from within by continuous enlargement of the embryo.

The first class can continue to grow indefinitely. The second can only develop what is found in the germ. To this class belong corn, wheat, oats, and all the grains and grasses. To the other class belong cotton, beans, peas, many garden vegetables, and nearly all the fruit and forest trees.

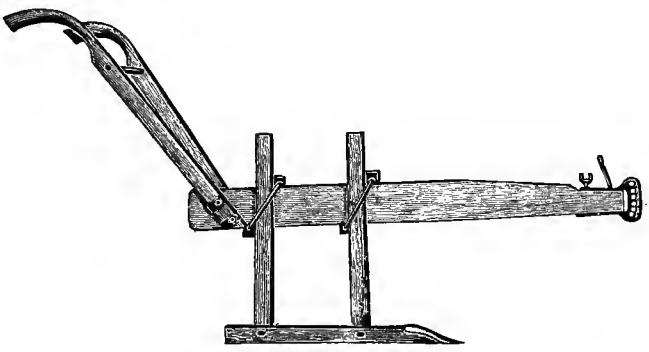
From what we have already said, it is clear that the soil must first of all contain the elements of plant food in sufficient quantity. Secondly, these must be in a soluble condition, or the plant can not use them. The difference between a rich and a poor soil is not in the quantity of the plant food, but in the solubility. Analysis shows that about the same quantity is present in all sorts of soil. Take a cubic foot of soil from the poorest-looking, washed hillside, and another from the richest-looking bottom land, and they will show about the same analysis. Again, take a cubic foot of soil anywhere, and then take a cubic foot just below, and they will analyze about the same. The lower foot will show generally a little more plant food than the upper. What, then, do we learn from these unexpected results?

We learn first that the productive power of the soil is not in proportion to the amount of plant food contained in it, but in proportion to the amount that is capable of being dissolved in water. The bottom land makes larger crops, not because it is richer in the elements of plant food, but because they are more soluble than in the soil of the hillsides. Again, the top soil will produce more rapidly than the subsoil, because the plant food in it is more soluble, not because there is more of it.

A little study will show us that the principal difference between these soils is in the mechanical condition. The clay taken from the worn hillside is hard; and the circulation of air, sunshine and water is hindered by this hardness. The bottom land is fine and loose, having been brought largely from the hills, floating in the water. Hence aeration can go on rapidly in such soils. The air, sunshine and water, and the combinations formed by these, circulate freely through such soils and dissolve the potash, phosphoric acid, lime and other substances in such quantities as to produce very rapid growth in plants. This work is called "aeration," and the resulting solubility is called "turning loose" the locked-up stores of plant food.

What we have said about the hills and bottoms is also true of the soil and subsoil. In the part loosened up by the plows and the harrows and filled more or less with rotting vegetable matter, much of the plant food is readily aerated and turned loose. In the compact subsoil, or hardpan, the work of aeration has been prevented. The plant food exists there abundantly, but

is not soluble and is not ready to help plants grow. Here we have one of the greatest lessons that science has ever taught the farmer. We see at once that, if these things are true, then the farmer has the key to success in his own hands. If he will pulverize the hillsides as fine and as deep as the bottom land soil, he will find them as rich. They will grow just as good crops. It is hard for the ordinary farmer to believe



A SUBSOIL PLOW.

this. Yet it is true. It does not rest on theory alone. Practice has proven it true in hundreds of places. Any farmer can try the experiment for himself. Now, this will not be the work of an hour or a day; it will take time and labor to pulverize the hillsides as fine and as deep as the bottom lands, but it can be done by using good plows, rollers and harrows, and by the help of frost and sunshine. Persevere and you will succeed. You can greatly expedite the process by using all the decaying vegetable matter possible. Again, it will require some time for nature

to do her part. Aeration will begin as soon as you begin, and keep along with you. Insoluble potash and lime and phosphoric acid will not all become soluble in a day. They will do so rapidly enough to pay you for all your labor and patience.

"The husbandman waiteth patiently for the early and the latter rain," but his reward is sure. Providence is on the side of the industrious person. Here we come back to the starting point. Plants grow by being furnished with plenty of soluble food. The elements of plants exist in inexhaustible abundance everywhere in the air, soil and water. These can be made soluble and available by the farmer. Deep plowing and repeated harrowing will do the work. In this way the farmer will be sure to earn his bread, though it be in the sweat of his brow.

QUESTIONS.

1. What do we study in Chapter X? 2. What are plants to the farmer? 3. What is the relation of plants and soil? 4. How are seeds made up? 5. How do they germinate? 6. Where do stems start? 7. Where do roots start? 8. What takes place next? 9. Describe root growth? 10. How do they get water? 11. What does the sap carry? 12. What is done in the leaves? 13. What is done with the waste? 14. What becomes of the plant food? 15. Is this work well done? 16. How do the mineral foods get in? 17. How do the air foods get in? 18. Do the violet and the oak grow alike? 19. What are exogens? 20. What are endogens? 21. How do they differ? 22. Name several of each class. 23. What must be in the soil? 24 What is the difference between rich and poor soils? 25. Does the quantity of plant food differ in different soils? 26. How is it in soil and subsoil? 27. What is the first conclusion? 28. Why does bottom land produce more? 29. Why does soil produce more than subsoil? 30. What makes the difference? 31. How does fineness keep the soil? 32. What is aeration? 33. What do we call the result? 34. What happens in loosened soil? 35. How is it in hardpan? 36. What lesson have we here for the farmer? What can he do? 37. Can it be done at once? 38. What will help? 39. Will patience pay? 40. How do plants grow? 41. Can the farmer help?

CHAPTER XI.

USES AND ABUSES OF WATER ON THE FARM.

We have spoken somewhat of the action of water in the soil and in the plant; but it will be well to look into this more closely. About four-fifths of the earth's surface is water, or perhaps we should say about one-fifth of our watery world is dry land, but this one-fifth is not very dry land. Water is in it everywhere. The soil is full of little pores, and water goes through all these and spreads itself all over the surface of each little particle. There is an ocean of earth water constantly ebbing and flowing through the ground. This water is carried by capillary attraction through the earth in all directions. It goes downward, upward, and sideways, clinging to the surface of the porous subsoil. When dry, hot weather comes and plant growth calls for large quantities of water, capillary attraction helps to bring the water up from the deep subsoil. All the time it is carrying the water along every way through the fine pores of the subsoil and the top soil. This earth ocean moves more or less parallel with the surface, but somewhat in waves like the sea.

Dig or bore a hole in the earth and you will soon find this water supply in greater or less abundance. It is always moving; never still or stagnant, unless

made so by some outside force. From this source come all our wells and springs. Not only is this water found in what we call the dry land, but it is found in large quantities in all growing vegetation. Some plants, such as melons, cucumbers and the like, are about ninety-eight per cent. water; taking in the hardest woods, about seventy-five per cent. of the vegetable kingdom is water.

A very large quantity of water is always present in the air in the form of vapor. We could not breathe dry air and live. Water enters very largely into all animal life. The blood, flesh, and even the bones are filled with water. The Bible speaks of "the Water of Life," and there is no life in this world without the presence and power of water. Water gives power to the germ in the seed to begin life, and carries all the food to the growing plant. Plants not only need enough water to hold their food in solution, but a very much larger quantity to do the carrying of such food.

The result of long and careful study shows that about three hundred and fifty pounds of water must be absorbed into the roots, sent up through the sap and thrown off into the air to leave one pound of solid vegetation behind. Single trees are said to throw off 24,000 pounds of water in a single season. This enormous quantity of water must be in the reach of this tree, but there are also very many other trees pushing their roots into the same ground and getting their part at the same time. When all of these have taken their supply, a great deal of water

must still be left in the soil to keep it moist and to enable it to furnish ample supply to meet future demands.

We thus see that a great supply of water is needed, if we grow large crops. The water necessary to make a common average crop of corn would cover the earth thirteen inches deep, if all of it was present at one time. About two thousand pounds of water must be carried up through the stalks of cotton to make one pound of lint. About the same quantity is needed to make one pound of corn. It is very plain that the larger the crops we wish to make, the more water we must have at hand. In a great many farms the amount of crops we gather is in direct proportion to the quantity of water we supply. This is a matter which the farmer can largely control. By intelligent work he can greatly increase the available water supply. By neglect or ignorance he can, and very often does, cut off the supply of water. We think the most important point in successful farming is proper management of the water on the farm We will now try to show you how the farmer can do this.

THE RESULT OF SUBSOILING.

The great law that governs the action of water is gravitation. This would cause all the water to go in direct lines toward the center of the earth, but various causes prevent or modify the operation of this law. We have already spoken of the law of capillary attraction, which carries much of this water sideways and thus modifies the law of gravity. It also reverses this law entirely by the help of sunshine and the pumping power of plant roots and cells. The mysterious power of life in plants and animals also helps in reversing and modifying the law of gravitation.

The looseness or hardness of the soil and subsoil have great influence upon the action of both of the great laws mentioned above. If the soil is too compact or tight, the water can not penetrate it. Hard soil interferes with the action of both laws. If we have a few inches of subsoil on a thick hardpan, the rain water can not penetrate it. If the rainfall be heavy or continuous, the small quantity of loose earth is soon saturated with water and can hold no more. So there will be a surplus collecting. Now what does this surplus do? The law makes the water run in the direction nearest toward the center when it can not go down in that direction. So the water takes the most convenient way down the hillside. In doing this, it is sure to carry with it first that part of the soil held in solution, and next the finest and lightest of that which is not in solution. Soon gullies are formed, and the best of the land is carried away to the bottom lands or the creeks, rivers and oceans. Sometimes, where we do not see gullies, great damage has

been done by carrying away the finest of the soil, and leaving only the heavy sand or coarse clay. We not only lose the water, but the soil also.

To do the best farming we need all the water that falls. All that runs off is that much lost. More damage has been done to the soil, and through that to the farmers, by washing, than by all other causes, in the hilly lands of the South. The washing should never have been allowed. It has taken many millions of dollars from our fields. We can not afford to let it continue. We need all the water we have. Can we keep it? We answer, we can. We say so, because it has already been done on many farms. How can it be done? We will explain. Break up the hardpan. Plow deep enough to connect with the porous earth, generally found twelve to fifteen inches from the top. Keep this loose and porous by frequent fall plowing with two to four-horse plows. Harrow often and mix all the vegetable matter with the soil. Run a complete system of levels on the farm, to be used as guide rows to plow and plant by. Do not depend on the levels to hold the water, but on the deep plowing. In this way the rain water can be controlled and made to enrich the fields instead of gullying and ruining them. In this way many of the abuses of water on the farm can be stopped.

But washing is not the only abuse of water. Plowing and pasturing land when it is too wet is another abuse. This is generally the cause of hardpan. Soil worked too wet and dried by sunshine and rain loses its value as a food bed for plants. Millions of clods

of all sizes are made which are worth no more to plants than so many sun-dried brickbats. The plant food in these clods becomes insoluble. They can not furnish any help to the growing crops.

This is not all the damage. They are too hard for the tender spongioles to enter. These little hair roots are made to go around them. Being thus constantly hindered in their work they are greatly delayed and damaged. Plants are small and unhealthy where otherwise they would be strong and healthy. The damage from this source can not be fully counted up. It is like interest; it eats while we sleep. Land thus damaged may recover, where well treated, after many years, but when this process is constantly repeated the land is finally worthless for farming uses. As clay soils hold water longer, they are more apt to be injured than sandy or loamy soils.

Another abuse of water is found in exactly the opposite direction. While water is needed, too much water, if still, may be harmful. Sunshine, air, and water must be mingled in proper proportions, or aeration can not do its work. Too much water will retard or entirely stop this work. So we must see that any excess of water is promptly furnished a way of escape, so as to do no harm in going. This can be done by the same means as have been shown to effectually stop washing. On nearly all our uplands deep, thorough breaking will pass the surplus surface water rapidly off below. In valley lands it will sometimes be necessary to cut open drains or ditches. In flat fields we are able to get the best results by underdrains. These

should be well plowed and laid with pipe or tile. Never work sour land.

THE USES OF WATER.

These are so numerous that we will not be able to mention all of them.

INTELLIGENT CULTURE.

First, it is the great solvent for all plant food. Nothing can do this work except water. It requires large quantities of water to dissolve many things.

Second, water is the only carrier for the plant food. All plants take this food and make their growth from water.

Third, a large part of all plants is water itself. No plant can live one minute without it.

> In earth and air and sea
> The living waters be.
> Plants there daily feed,
> And find supplied every need.

Where there is water there may be life. Where there is none there must be death.

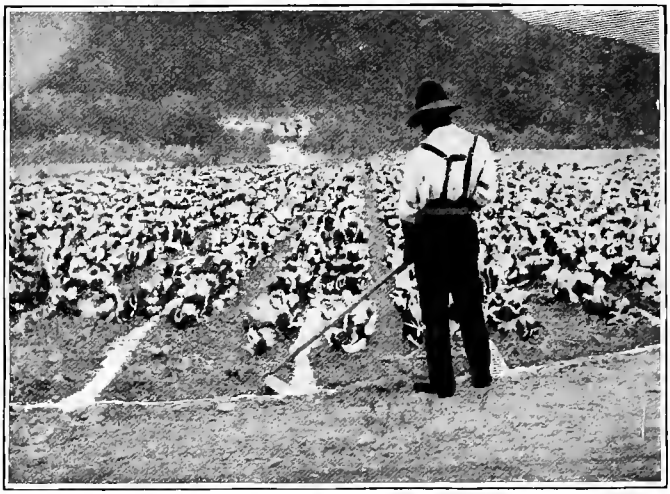
Fourth, if the water is held in the farm it greatly enriches the soil. Water not only carries the food, but is itself an important part of plant life.

Often a soil seems very poor because it will no longer produce good crops. All that is lacking is a sufficient quantity of water. This fact has been known for thousands of years. In order to remedy this trouble, numerous methods for supplying the needed water have been used. Our earliest historical records tell of men practicing irrigation or artificial watering. In many parts of this country it is largely used now. Millions of acres of land on the great western plateaus and in California are utterly worthless without water given in this way. But when the water is thus supplied these become the most productive soils we have.

There are three principal ways of doing this.

First, we take running streams, and by using dams and ditches turn them from their natural bed or channel and carry them by gravity over the fields to be watered. To do this successfully, often requires very large outlays of money and skillful engineering. Canals have to be made hundreds of miles long and large

enough to carry large rivers. Smaller and still smaller ditches are carried from these until finally the water is turned in small streams upon the fields. This method is largely employed in growing the fine fruits and grapes in California, and can be made use of wherever the country is broken and the streams have



IRRIGATING A CABBAGE FIELD.

a good fall. Even where we have rain this adds very much to the yield.

A second method is to use windmills and steam-pumps and raise the water from wells, lakes or rivers, and then distribute it much as above described, the chief difference being in the method of obtaining the water. This method is generally used where there are no streams with sufficient fall, or on the plains where

there are no streams at all. The water thus obtained is frequently measured out to the customers at a certain price. By these tolls the expenses of the system are paid Private waterworks may be often utilized to greatly increase the yield of vegetables in our domestic gardens.

The third method of irrigation, if we may be pardoned for a somewhat new use of this term, is to irrigate from below, instead of from above. By this we mean that we may plow the soil so deep and pulverize it so fine that capillary attraction will bring up the water when it is needed, provided we have taken care of the fall of water in winter, when we did not need it. The heat of the summer sun and the pumping power of the plant root will greatly assist in bringing up the water. If the land has been properly plowed, the plant roots will grow very deep in the soil—from three to seven feet, and as each of these is a skillfully made pump, all of them, acting at once, will be able to bring up great quantities of earth water. A great advantage in this method of irrigation is that, besides helping to secure all the water needed, it will help in very many other things. It will prevent all washing and leaching, and will make the soil deeper and richer from year to year. All the time it will be yielding larger and larger crops. Keep in connection with the earth water below, and this water will, by percolating through the pores of the soil, supply the growing plant with the life-giving water in hot summer. Short drouths will not injure the crops. Thus, when the poorly farmed land yields short crops, this properly worked land will give large

crops when the prices are best. The farmer who properly manages the water on his land will be almost sure to be a prosperous man. He turns what has often been the greatest curse on the farm into what Divine Providence intended it should be: the greatest blessing.

QUESTIONS.

1. What is the subject of this chapter? 2. How do water and land compare? 3. Is there water in the earth? 4. How does it move? 5. How does heat affect it? 6. Describe its motions fully. 7. How do we prove this? 8. Is there water in plants? 9. How much of them is water? 10. Is there water in the air? 11. Is it found in animals? 12. Is there any life without it? 13. How much water do plants absorb? 14. Do they use it all? 15. How much do trees evaporate? 16 How much is needed to make a crop? 17. How much to make a pound of lint or corn? 18. How can we increase the crop? 19. Can the farmer regulate this? 20 What is the most important point? 21. What law governs water motion? 22. What laws change this? 23. What helps? 24. What else? 25 What condition of soil is best? 26. How does hardpan act? 27. How does water start gullies? 28. Is there damage without these? 29. Do we need all the water? 30. What has done most harm? 31. Can this be stopped? 32. How? 33. How shall we plow? 34. What will result? 35. How can plowing hurt? 36. What does wet plowing do? 37. Does this prevent proper root growth? 38. Is it harmful? 39. Can this be remedied? 40. What soils suffer most? 41. Does water ever do harm? 42. How? 43. What is the remedy? 44. How should flat fields be helped? 45. What is the first use of water? 46. What is the second use? 47. Third? 48. Fourth? 49. What often causes poor soils? 50. How can this be remedied? 51. What is the first method of irrigation? 52. Is it costly? 53. Does it pay? 54. What is the second method? 55. Where is it employed? 56. What is the third method? 57. What will help to raise the water? 58. Wherein does it prove to be a great advantage? 59. Whence and how does the water come? 60. What is the result to the farmer?

CHAPTER XII.

PLANTS AND THE ATMOSPHERE.

Plants take root in the soil, but grow mostly in the air. They also grow mostly from the air. About ninety-seven per cent. of a dry plant will burn in the fire. All of this comes from the air, hence it goes back into the air. Plants can not create anything. They simply have power to rearrange things and thus form new compounds. They gather from the air carbon, oxygen, hydrogen and nitrogen. These and their compounds make all the woody parts of plants, called fiber. All their starch, sugar, jelly, oils and gluten are drawn from the air. We do not fully understand how this is done. Some of these substances, such as carbon dioxide and hydrogen, were formerly thought to be absorbed or taken into the plant through the leaves. The nitrogen, oxygen and ammonia are thought to enter the plant through the roots, but some plants seem to have the power of getting their ammonia through their leaves. It is now thought that even the air must furnish its food to plants through the roots. Little microbes in the nodules or warts on the roots of clover, beans and such like plants, contribute to this work. But whether the plants get them through the leaves or roots, it still remains true that by far the larger and nearly all the valuable parts of plants come from the air, and not from the soil. This fact is very important,

because these substances are in inexhaustible quantities in the air; besides, all burning and decaying is constantly throwing them back into the air. All animals constantly breathe out carbonic acid gas, the most important of these. The winds keep the air pure and ever changing, so that no part of it can lose its share of any one of these gases. We must not, then, fear that the supply of plant food will ever be lacking in the air. We need only to look after the soil. Providence will look after the air. So that, while time shall last, "seedtime and harvest shall remain."

But while we can not mix or unmix the air elements of food, there is much we can do to assist plants in getting their fuli share of help from the air. While the roots grow underground, they must have air, and the elements of plant food in the earth can not be prepared for plant use without free circulation of the air through the porous soil. By keeping the soil loose we greatly aid both processes, while permitting the soil to bake much hinders the circulation. So that, whether we look to the soil food or the water food or the air food, we find that the mechanical condition of the soil has much to do with success. To look after this is the mission of the farmer.

Although our knowledge of the winds is limited, yet they are of much importance. Upon their bosom ride the clouds, and before the Storm King the strongest trees often bow.

"He that observeth the wind shall not sow, and he that regardeth the clouds shall not reap." Strong winds and cold currents often injure tender vegeta-

tion, and we should select places for planting in all cases with due reference to preventing all the damage we can. In many places crops may be very well protected by leaving a body of woodland on the north and northwest sides. In open countries it will often be found profitable to set out trees for this purpose. Plants can not live without water, neither can they live without air. The leaves act much as lungs for plants, but air is found present in every part of the plant. As water conveys food to the growing plant, so to a large extent the heat is carried to the plant by the air. Heat is needed at every step in plant life. Germs can not sprout without heat. Chemical changes can not take place without it. Growth is dependent upon it.

Very many seeds are entirely dormant in soil below forty-eight degrees. Above that, they begin to show signs of life. At from sixty-two to sixty-five degrees, life becomes very active. Growth is more and more vigorous as the temperature rises. Hence we see the amazing growth of all sorts of plants in the tropical regions. The sun is the original source of this heat. The air is the medium which receives, holds, and distributes it to the roots and to the sap of plants.

QUESTIONS

1. What is the subject? 2. How much do plants get from air? 3. What substances do they gather? 4 What do these form? 5. How is it done? 6. What helps to do this work? 7. Is it well to know these facts? 8. Do animals contribute to plant growth? 9. What can we do to help? 10. Does the mechanical condition help? 11. Have winds any effect? 12. Does air help? 13. Does heat help?

CHAPTER XIII.

MANURES AND FERTILIZERS.

Manure is anything which has once been a part of plants or animals, or both, but is now decayed or decaying. Rotting vegetable or animal matter of any kind is more or less a manure. The word is generally used to mean the refuse from domestic animals. Hence we speak of horse manure, cow manure, sheep manure, hog manure, and so on. The general name of all these is lot or stable manure, sometimes called barnyard manure. When these substances decay they become soluble in water and then furnish plant food. Thus they cause plants to grow very rapidly. Having once been plants, they are apt to furnish all the kinds of food needed, and about the right quantity of each. The voidings from animals are rich in the elements needed for plant-building. This is particularly true of the liquid. Hence, by using some vegetable waste, such as leaves or straw, or even sawdust, to absorb the urine, we greatly increase the quantity of stable manure. We also improve the quality. The liquids are already dissolved. The solids must become so before we are helped by them. Farmers who fail to use the liquid manure from their cattle lose the best half. The solid or liquid voidings may be kept together or separate, but neither should ever be lost. If both are preserved together, we have a perfect or

complete manure, suited to almost every plant, and to every kind of soil. We have already shown that a very small amount of a needed constituent will exert a great influence in the growth of any plant. Small quantities of soluble manure may thus increase the crop. Sometimes we get two or three times the yield by adding a small quantity of manure.

The soil of any field or farm may be so injured by previous bad work or bad cropping that it has no available food of some kinds. There may be plentiful supplies of mineral substances, but a lack of ammonia, and the crops will be poor. Supply this need and the crops will be bountiful. A field of wheat containing fifty acres, lacking this ammonia, might only be able to yield a crop of ten or twelve bushels per acre. Use some stable manure, costing about three dollars per acre, and the yield is often run up to twenty or thirty bushels per acre. We thus have a profit of ten to twenty dollars per acre, or five hundred to a thousand dollars on fifty acres, from the use of one hundred and fifty dollars.

This wonderful change was brought about in part by supplying the lacking constituent of plant food, but this was not all that was done. There were in the decaying manure microbes which caused a process of fermentation to begin in the soil. This created acids and gases, which helped to decompose the plant food already abundant in the soil. But they were not soluble before, and could not be used by the plant. Now they are made soluble, and the power of the soil to produce crops is greatly

increased. This fermentation changes the soil much as yeast changes the dough. Thus we get from the use of stable manures benefits far beyond the cost of the plant food in them. To get the full benefit from them, they should never be allowed to get wet, or be leached by rains, before they are put in the fields. The most soluble part is always the most valuable part. As soon as they get wet this part is dissolved into the water. If the water is permitted to run through, it carries this away with it. Millions of dollars' worth of the very best plant food is lost in this way every year. It either soaks into the earth or evaporates into the air. In either case the farmer loses it.

There would be just as much business sense in a farmer throwing five and ten dollar bills into the fire as there is in his permitting his manure to be ruined in this way.

Manures of all kinds should be kept under shelter, and only given enough water to assist in the rotting. If properly handled, the urine will generally supply this. When taken from the shed or barn, the manure should be spread broadcast upon freshly plowed ground, and harrowed in. If this can not be done at once, then as soon as can be. Plow the ground, so as to get the manure mixed with the soil as soon as practicable. More or less loss is going on until this is done The advantages of spreading the manure are many and important. We have spoken of the fermentation and its good effects upon the soil in turning loose locked-up stores of plant food. We can see at once that this can be done better if the manure is mixed

with all the soil than if it be confined to narrow streaks and spots. Again, plant roots go everywhere through the soil, seeking food. If the supply of food is uniform, the crop will be so and the plants will be healthier. If the manure be only in the row or hill, then only those roots which are there can get any good from it. So we lose very much by using manure in drills or hills.

Another great gain in keeping manure dry is in the handling and hauling. One ton of manure will easily absorb several tons of water. Many farmers pay more in labor and in money for handling and hauling the water than the manure.

The quantity and quality of the manure depends somewhat upon the feed. Cattle take away very little from the available plant food in the vegetable matter fed to them. They consume chiefly the elements which come from the air. They add to the manure waste material from their blood, flesh and bones, which increases the value. Hay and grain foods, such as cotton-seed meal, wheat bran and oil cake, support the cow with only part of their contents. A large part of these and all other food substances pass on to the manure heap, rich in all the elements of plant food. This has been rendered more soluble by the process of digestion. A ton of cotton-seed meal will give flesh to the cow and increase the flow of milk, improve the yield of butter, and furnish nearly as much for plant food after being fed to the cow as before. The cow has taken some, and added some from the waste of her own system.

It is hardly possible to keep up a high standard of fertility on our farms without the aid of cattle. The cow seems to be the cheapest guano factory the farmer can patronize. She gathers up from the highways and the byways, pastures and hedges and odd

A MONEY MAKER

corners much that would be lost. Cattle-growing has been a leading feature of farming in all ages and countries. We might sum it up this way: Grow grass to feed cattle, to make manure, to make the land rich, so that we can grow more grass to feed more cattle to make more manure, to make the land richer, to grow more grass, and so on forever.

Barnyard manure is suited to all crops, but is not the only good manure. All decaying vegetable matter makes the soil richer. Stubble and trash of all kinds should be plowed in. They keep the soil porous and warm, as well as add some plant food. Some plants take nitrogen from the air and leave it in the soil. Clovers and leguminous, or pod-bearing, plants generally have this power. Cowpeas are very valuable for this purpose. Very poor soils have been made rich by sowing a pea crop after a grain crop for a few years. The vines are good for manure, and help to enrich the soil, if left to die and decay on the field; but the most good is done by the roots. The vines are so much more valuable for hay that it is not good farming to let them rot. They are worth about fifteen dollars per ton as hay, and about four dollars and fifty cents for manure It is poor economy to lose this difference—about ten dollars per ton. But we need not lose anything at all. Save the vines and feed them, and thus get the hay value in full and the manure value in addition thereto. The droppings from cattle fed with pea-vine hay are very rich.

Not only are vegetables valuable for manure, but decayed animal matter also is rich in plant food. Even the bones and hoofs and horns of animals are valuable for manuring purposes. They form the basis of many of the best guanos. Rotting fish are largely used for the same purpose. Manures and fertilizers are often spoken of as though they were the same. Strictly speaking, they are different in some important respects. Manures are the result of natural decays. Fertilizers

are chemical compounds. The plant food they contain is made soluble by strong acids. Animal bones are ground fine, and the acid is added to the flour By the action of the acid, more or less of the phosphoric acid, potash, lime and mineral elements are made soluble in water. These compounds are called acid phosphates, superphosphates, and so on, according to the quantity of the different elements. If sulphuric acid is used, they are called sulphates. If nitric acid is used they are called nitrates. If carbonic acid is used, then they are called carbonates, and so on through the list.

THE OUTGO.

If the substance used with the acid is potash, then we have the nitrate or sulphate or muriate of potash.

If soda was the base, then we have nitrate of soda. If lime, we have sulphate or carbonate of lime. These chemical compounds are carefully analyzed, and the exact proportions of the different elements made known. This soluble percentage of each plant food must be plainly marked on the sack or barrel, and guaranteed by the parties selling. This is for the protection of the farmer. By looking, he can see what he is purchasing. They are generally sold by the ton of two thousand pounds. Thus, eight per cent. phosphates means that in a ton there are one hundred and sixty pounds of soluble phosphate; two per cent. potash

means that in a ton you will get forty pounds of potash In a ton of phosphate we get about these quantities of plant food—two hundred to two hundred and forty pounds. Now, if we distribute these, as is the custom, at about the rate of one hundred and fifty to two hundred pounds to the acre, we are putting on each acre about ten or fifteen pounds of phosphate, and two and one-half to four pounds of potash per acre.

We expect these small quantities to cause a great increase in yield. Often they do. We often have four to six thousand stalks of corn per acre, and ten to fifteen thousand stalks of cotton. If the roots find all we give per acre, how much potash would one stalk get? Two thousand corn stalks will divide each pound among them. Four thousand cotton stalks must feed on each pound.

Experience shows that, besides potash, phosphoric acid and lime, we need nitrogen for very many crops. This is added to the phosphate by the use of nitrate of soda, Peruvian guano, decayed fish, dried blood, cotton-seed meal, and many other substances. Plants seem to require that the nitrogen be given to them in the form of ammonia. We find this generally guaranteed on the sacks in about the same quantities as the potash—one and one-half to two and one-half, sometimes three per cent. This little change gives a new name to the compounds, and they are called complete fertilizers, or ammoniated guanos. It adds considerably to the cost per ton. It is very readily dissolved by water, and constantly tends to evaporate in the air, particularly if exposed to hot sunshine.

Guanos differ from the others in the fact that they are natural products of the earth, produced from the deposits of millions of birds, or rotting fish bones, or both combined. They are generally found in tropical regions. They are very rich in nitrogen. This element determines their comparative value. Peru furnishes us with most of the highest grades. The name, however, is often applied to manufactured goods containing ammonia. Strictly speaking, they belong to the manures, for manures are made by natural processes; fertilizers by chemical processes.

To the farmer this distinction means a great deal. What is made by chemical processes he can not make. This he must buy. What is made from natural processes, he can make for himself. This he need not buy. If you understand your business, you can make your own. You need not buy Cotton-seed meal is the chief source of ammonia for farms.

But there is another very important difference between manures and fertilizers. Manures make the soil richer at the same time that they make the crop larger. They do this by constantly adding to the soil much vegetable matter which, though not immediately soluble, will soon become so by the agencies already at work in the soil, and by the fermentation which they cause to set up in the soil. Thus, by nature's own methods the work of enriching the soil goes right on, while the soil is making the owner richer year by year.

This is not the case with chemical fertilizers. They are prepared by a definite formula, and prepared to do a fixed amount of work and no more. They carry to

the plant a small quantity of dissolved food. This is all they can do. We have already seen how small this quantity is. They supply in some soils what is wanting and this is all they can do. They may, and very often do, increase the growing crop. They act like the iron in the blood. They make the plant healthy and strong, so that it sends out many active roots, which feed on the soil food, and thus a heavy growth is secured; but they make very little contribution to the permanent food supply of the soil. They have rather stimulated it to extra effort, and often it is left poorer.

The long continued growth of heavy crops by the use of commercial fertilizers alone does not build up a high state of fertility. Now, we have in the first twelve inches of soil about four to eight thousand pounds of phosphoric acid, sixteen hundred pounds of potash, and from five hundred to four thousand pounds of nitrogen to each acre of land. The next twelve inches have rather more of all except nitrogen. What we need then is a system of culture which will make available these vast quantities of locked-up plant food. Using chemical fertilizers does not do this. Using homemade manure does help to do so.

Chemical fertilizers are useful if properly used, and often pay a good profit on the investment, but we should never learn to depend entirely upon them. Southern farmers have enough ammonia in their cotton seed to supply not only their own needs, but to supply any farm in the United States.

QUESTIONS.

1. What do we study here? 2. What is manure? 3. How is the term used? 4. What are lot manures? 5. How may we improve these? 6. Why is the liquid so valuable? 7. Do small quantities help? 8. How? 9. What result on fifty acres of wheat? 10. How does manure so increase the crop? 11. How does fermentation help? 12. Why should manure be kept dry? 13. Can the farmer afford to let his manure be leached? 14. What should he do with the manure? 15. Why should it be mixed with the soil? 16. What other reason for this? 17. Why broadcast it? 18. Why keep it dry? 19. Does feed alter manures? 20. Do animals add anything? 21 How? 22. How else do they improve manure? 23. Can a farm be kept rich without animals? 24. How may we express this? 25. What is said of barnyard manure? 26. What of other kinds? 27. How do some plants help the soil? 28. Do vines or roots do most good? 29. What is the better use of vines, and why? 30. How else do animals furnish manure? 31. Are manures and fertilizers the same? 32. How do they differ? 33. How are fertilizers made? 34. What is the effect of the acids? 35. What are they called? 36. How specially named? 37 What if potash is the base? 38. What if lime? 39. How do we know their value? 40. How are they sold? 41. How much soluble plant food in a ton? 42. How much phosphate per acre? 43. How much potash? 44. How much to a stalk of corn or cotton? 45. What other food do plants need? 46. Where do we get it? 47. In what form do plants use nitrogen? 48. What are these compounds called? 49. What about cost and evaporation? 50. What are guanos? 51. Where do we get them? 52. To which class do they belong? 53. Why? 54. Is this important? 55. Why? 56. What is the chief source of ammonia? 57. What other difference between manure and fertilizer? 58. How do manures act? 59. How do chemicals act? 60. Is this profitable? 61. How? 62. Do they help the soil? 63. What does the first foot of soil contain? 64. What does the next? 65. What do we need? 66. How shall we get it?

CHAPTER XIV.

HOW TO USE MANURES AND FERTILIZERS.

Very much of the profit of farming comes from the skillful use of manures and fertilizers. Manures are generally coarse vegetable matter in process of decay. To get the fullest benefit from them, we must so direct this decay as not to lose any of the constituents of plant food. Some of these, the nitrogen and ammonia, for instance, will readily evaporate and thus be lost. Others, such as the potash, are readily dissolved and carried away with the water. But a certain quantity of water is needed to help the decaying process.

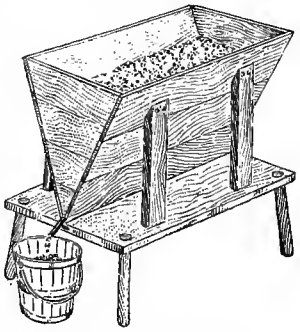
Many books have been written on the subject of compost. This consists of heaps of stable manure combined with other vegetable matter, mineral compounds or chemical fertilizers, or all of these at once. The object of composting was to reduce the manure so that it can be mixed more thoroughly with the soil. The mineral and chemical substances were used to absorb the ammonia, potash, and other substances as the heap rotted. The end in view was to get a resulting compost that would furnish all the elements of food in readily soluble condition. When these heaps were made they became very much heated, as the rotting process is slow burning. The heat at first hastens decay, but when very hot destroys the best elements of plant food.

Long experience and thousands of experiments have tended to change the views of our best farmers. We now find that we get better results by composting in the fields. Instead of costly work, long continued after the old style, we believe it to be better to carry the manure directly from the stalls or sheds and spread it upon the field, and if we wish to add other substances, do so as we distribute or afterwards. It will be profitable to keep on hand German kainit, acid phosphate, and gypsum, or land plaster, and sprinkle these over the manure as we clean the stalls or pile the manure under the shed. These will absorb all escaping gases. When it is not convenient to do so, the same results may be obtained by mixing them in the field.

The advantage of this method is that the chemical reactions take place in the soil and help to make it loose. At the same time they cause other chemical changes in the soil itself. Another important point in the use of manures is their application as to depth. Many have contended that they should be put deep down in the soil to prevent loss by evaporation. This idea is not well founded, because the fine soil is a wonderful absorbent and readily holds all gases. Dust is the best destroyer of all odors or smells. Another reason why this is not best is found in the fact that the valuable part is the soluble part. Water tends to go down, and the general tendency is to carry all soluble elements with it. We find this illustrated in the common farm ash barrel or hopper. We put the ashes in, pour the water on top, clear as

crystal. In a short while this same water runs out at the bottom but not clear. It has taken the soluble potash from the ashes along with it, and is now a highly colored lye.

So in the field the tendency is for the water to carry all soluble plant food downward. We say, the tendency, because capillary attraction and root action very greatly modify this. But this tendency is so strong that it is safe to apply most manures very shallow. Some do the best work when used entirely on top of the soil. The only danger in shallow application is due to the fact that manure is useless without water, and the seasons may sometimes dry the soil below the manure. In such cases the manure can do no good. A safe rule is to apply all manures shallow in the fall and winter, and a little deeper in spring and summer.



ASH HOPPER; THIS IS THE WAY PLANT FOOD IS CARRIED.

Another point of great value to the farmer is equal, thorough distribution. Every inch of soil will be filled with roots seeking food, and every inch should have food ready. If the manure is put in the drill, a strong plant is started, and calculations are made for a vigorous crop. When the fruiting season is reached and the demand for food is heaviest and every energy of the plant is strained in search of needed nourishment, then the roots are thrust out to the middle and find a soil much poorer than that in which the plant

started. There is disappointment. The plant begins to readjust. It can not secure the needed food. It throws off the young fruit. This reaction is always hurtful, sometimes ruinous. The limbs or leaves are already formed. Being tougher than the young fruit, they hold on, while the fruit falls. Cotton-growers suffer immense loss in this way. Other plants may not show the harm so plainly in the fields, but they will in the barn. The wheat grains will be fewer, smaller and lighter. Corn will give nubbins instead of full ears. If all the soil had been alike, the growth would have been healthy and the crop better—less stalk and more fruit.

Again, the manure, when thoroughly mixed, will be reached by more of the soil water, and hence more of it will be dissolved.

What we have said about manure is, in general, true about fertilizers. The soluble part is the only useful part, and they should, therefore, be used shallow. The food in them, being ready for immediate use, if placed all in the hill or drill, will give an unnatural stimulus to the young plants. As this kind of plant food is always costly, the farmer should get the greatest possible good from the first crop. This he can not do if only a few of the plant roots reach the supply of food. All plants need most help when putting on fruit. Part of the food should always be reserved for the fruiting season. For this reason many have felt that only a part of fertilizers should be used when planting. The other part should be put in when cultivating cultured crops, and used as a top-dressing

on grain or grass crops. Experiments lean strongly to this theory. Whatever the method of using, the success will be greater if the soil and manure be thoroughly stirred together.

The quantity to be supplied is an interesting question. We have already said that extremely small quantities of soluble plant food make great increase in the yield. Where a pound of potash, phosphoric acid or nitrogen has been given, to be divided among thousands of plants, the effect has been great. Does it hold true that we can increase the crop as we increase the foods? It seems to be true. Many experiments seem to show that a ton of fertilizer per acre will give a larger clear profit on the money cost than 150 pounds. Good common sense and great skill are needed in using these great quantities. There must be a corresponding increase in the depth of the soil, the supply of water, and number of plants per acre. The culture must be rapid and skilled.

With proper care there seems to be no known limit to the quantity that may be profitably used. Market gardeners and truck farmers find it profitable to cover the soil several inches with good stable manure. More than forty tons per acre are sometimes used. After they have mixed this thoroughly with the soil, they sometimes add large quantities of chemical fertilizers. In this way they are able to grow many successful crops on the same soil in one year. The danger line does not seem to lie in that direction. Strange as it may seem, it is in many cases true that rich soils show greater profits on high manuring than poor soils. This

can be understood if we remember the statement already made that soils are poor on account of bad mechanical conditions. These conditions do not give the added food a fair chance. The better crops your land is able to produce, and therefore the less it seems to need manure, the better it will pay you for high manuring. A healthy man can eat and digest a larger dinner than a delicate, sickly one.

There is another important side to the question of manuring. All crops do not need the same food. While certain of the substances already named are found in all plants, they are not required in the same quantities by each. Again, the available plant food in all soils is not the same. Put these together and we see that very different amounts of certain substances would be needed to produce the best crops. If a soil is lacking in potash, but pretty well supplied with phosphoric acid, lime and nitrogen, you need only to supply the potash and get a good crop. This would be still more needful if the crop we wished to grow on that soil were one that requires a large quantity of potash. If two of these substances are lacking, then we must supply both. Simply supplying one would not secure a good crop. If potash and phosphoric acid are both wanting, then supplying the potash would not produce the crop. If phosphoric acid alone be added, we will not get the crop; but if we add both the potash and the phosphate, we get the desired yield.

We have some soils in which very little of either of the four needed elements is soluble. Such soils need

a complete manure. Stable manure suits such soils. Ammoniated standard guano suits such fields. So that we find that different crops demand different help. Wheat needs ammonia as well as phosphate. Oats seem to do as well with phosphate alone in the fall or at sowing time, but all grains and grasses rejoice in a top-dressing of a highly ammoniated preparation in the spring, while growing rapidly. Indian corn does well with phosphate and potash. Grapes, watermelons and other fruits and many vegetables do best with large doses of potash and some phosphate added. The cotton plant will do well with a complete fertilizer, but does not seem to care much if you leave out the nitrogen. The legumes generally get all the needed nitrogen from the air. They need potash and lime.

By studying these things farmers may save hundreds of thousands of dollars now wasted by putting on crops the wrong substances. The proper plan is to get the several articles and do your own mixing. In this way each crop can be furnished with what it needs, and nothing be lost. The separate articles can be bought very much cheaper than ready-made mixtures, and about fifty per cent. may be saved in this way. Phosphate flour, potash or kainit can be bought very cheap, if taken in car-load lots, unsacked. It is true that many will not need a car load, but several farmers can join to purchase their needed supplies.

Nitrogen is the most expensive item. In Southern States we need to buy very little of this, because

we have cotton seed in abundance. Cotton-seed meal furnishes the very best form of ammonia for farm use. If you do not own a cotton-oil mill, you can easily exchange your seed for the meal. But if all the barnyard manure is saved and used, and all vegetable matter on the farm turned into the farm soil, very little additional ammonia will be needed. It is cheaper to make ammonia than to buy it.

We are not opposed to the use of chemical fertilizers, but we do believe that very much money is wasted in this business. We think that when our boys are so taught as to understand the science and art of farming, they will need to buy very little manure of any sort. Culture and economy of home supplies will make their farms rich.

Plants do not create anything. All the growing crops do not add an ounce to the material world, nor does their death and consumption take away anything. They only change the form of the matter. It is the farmer's place to direct in these wonderful changes, without which the world would soon die. If he does this wisely, he will be prosperous and happy. If he does it ignorantly, he will be poor and unhappy.

QUESTIONS.

1. What do we study in this chapter? 2. What adds to the profit of farming? 3. What is the nature of ammonia? 4. What of potash? 5. What is said of compost heaps? 6. What was the object? 7. What happens first? 8. How does the heat act? 9. What is the present belief? 10. How do we preserve the gases? 11. What are the advantages of mixing in the field? 12. What do some think of applying it deep? 13. Why is this unnecessary? 14. What other reasons? 15. Illustrate. 16. What is the tendency? 17. What hinders? 18. What is the only danger in shallow use? 19. What other point is important? 20. What evil results from drilling manure? 21. What is often the result? 22. Why does fruit shed rather than leaves? 23. Do other plants suffer as well as cotton? 24. What other good results from broadcasting? 25. Is same true of fertilizers? 26. Explain their action. 27. When do plants need most help? 28. What, then, may be best? 29. Will thorough mixture always pay? What about the quantity? 30. How should large quantities be used? 31. What about the plowing, water, etc.? 32. Is there any limit? 33. How do truckers manure? 34. What if the soil is rich? 35. Is mechanical condition important? 36. Do all crops need the same manuring? 37. Why not? 38. What constituents of plant food must be supplied? 39. What if two are lacking? 40. What if all four? 41. What does wheat need? 42. What do oats need? 43. What do all grains and grasses need? 44. What suits corn? 45. Grapes, melons and fruits? 46. Cotton needs what? 47. Legumes need what? 48. What is the proper plan? 49. What can be saved? 50. How? 51. Do Southern farmers need to buy ammonia? 52. What will result from education? 53. Do plants create anything? What is plant growth? 54. What can the farmer do?

CHAPTER XV.

PLANTING.

Much of the success of any farmer depends upon the choice of his crop and the planting. It is no easy matter to decide just what we shall plant. It will not be wise to plant just because a plant will grow. We want to consider many things. What do we know how to plant successfully? If we do not know how to make any given crop, it is folly to plant that crop. A farmer who knows nothing about the culture of tobacco should not risk his crop in tobacco. So of any other crop. First study yourself and see what you are able to grow successfully.

We must consider our climate and what will best grow in our latitude. Pineapples are very good things to eat, and sell well, but it is worse than folly to plant pineapples in a cold climate. We must study our market surroundings. Hops might grow very well where we live, but, if nobody uses hops, it would not be profitable to grow them. We want to have such crops for sale as will find a market. Sometimes the market may not be near at hand, but may be sure and profitable. Then we must study the question of transportation. Some crops bear transportation a long way and pay well. Others will grow well in the South, and are in great demand in the large cities of the North, but cost too much to carry, or perish too quickly on

the way. We must not plant unless we can secure labor when needed. It is folly to plant and lose for want of labor.

Then again, some soils are adapted to the growth of some crops, but not to others. We must study our soil adaptations. These and other minor points need careful thought before we can decide what to plant. Often we will find that it will not be best to confine our attention to a single crop, but to plant many sorts. When this is the case, a due proportioning, so that they will not interfere with each other in culture, gathering, marketing, and so on, must be considered.

Perhaps the most important question just here will be, what are we planting for? If for the market, then one line may be best. If for home consumption, then another. Generally both will enter largely into our plans, and to balance them well will insure success. The man who makes his living from the soil is never wise if he buys what his soil will grow. Home supplies should always be first provided for, market supplies afterward.

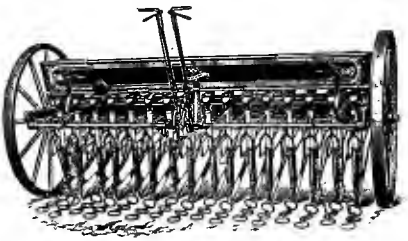
Giving careful thought along these lines, we decide what to plant. Next in order, we come to think when to plant. Very many have no settled ideas on this point. They see others planting, and they plant. Very often failure results from planting at the wrong time. Seeds seem to have a sort of sense of timeliness. Many of them will not germinate till the proper season comes. Grain crops, if sown too early in the fall, are liable to be injured seriously by insects. They may also grow too much before winter begins, and then

be ruined by the freezes. On the other hand, if sown too late, they can not develop sufficient roots to resist the winter freezes. To know just when to sow each crop is, then, a matter of great importance. Of course, this varies very much in different localities. Each man must study this question for his own surroundings. Much the same is true of spring-planted or annual crops. Some of these need a long growing period. Others need a rapid growth. Hence some should be planted early, others late, when the soil is thoroughly warm. The nature of the plant and the condition of the soil are important considerations on this point. A happy medium is generally safe.

Many think the moon's phases are important. They tell you with great confidence that you must observe the moon and plant accordingly. This advice is contrary to science. The moon's phases are never the same two successive days as regards any particular locality. There are no quarters of the moon. It changes all the while, and not at stated periods. Again, these people do not agree among themselves. Take the trouble to keep a careful record and you will soon find that they advise differently. But the question is at last one to be settled by experience, and not by argument. Experience shows that the plants do not observe the phases of the moon, but grow according to the intelligence and industry of the grower.

This is a superstition of the Dark Ages, handed down from sire to son. It is noticed here because it has such a strong hold upon the popular mind. One reason for this is that men who are careful

enough to have certain rules here, will be apt to be careful in all their plans and systematic in all their work. Such men generally succeed. Their success gives dignity to this superstition. Such deep-rooted traditions can be corrected only by science and education. Instead of sneering at them, we should constantly turn on the light. Do not farm in the moon. Farm on your soil. Study your climate and the nature of the crops you wish to grow, and plant wisely and well.



THE SEED DRILL, A GREAT LABOR SAVER.

How to plant is another important question. Shall we plant shallow or deep, broadcast or in drills?

Such inquiries need attention. Many seeds are lost by planting too deep. Others are fed to birds, or perish by sunshine, because they are not covered, or too lightly covered. Small grains, generally, should be covered from three-fourths of an inch to an inch and a half. They may come up outside of this range, but they will do nothing. The shallow-rooted plants will be apt to be killed by winter freezes. The deep-rooted will perish, because they can not stool or joint.

For spring crops, it is well to have reference to the supply of moisture. Many seeds, cotton for instance, do well planted shallow if the spring droughts do not dry the soil below the seed. In all cases the soil should be very finely pulverized, and pressed firmly

around the seed. Success often depends largely upon this pressure. Small seeds, such as turnip, will rarely fail to come if the soil is pressed after planting. A roller is the best tool for this work.

Securing a stand is one of the essential points in successful farming. With a stand we may succeed. Without it we can not. Replanting does not often pay for the trouble. A good stand means enough plants, not too many and not too few. There is almost as much damage on one side as on the other. Too many plants weakens all the plants. If any small grain crop be too thick, the evil can not be remedied. This is a frequent cause of injury to crops. Even the cultivated crops suffer from this cause. An overstand of corn weakens all the stalks, and produces small ears or none at all. Even when removed, unless this is carefully done very soon after the corn comes up, there is damage. The young stalks which are removed have taken part of the food needed for the stalks that are left. Besides this, there is more or less tearing of the roots of the plants which are left. All of this works harm to the crop.

With cotton it is customary to plant very much more seed than is needed for a stand. Usually we plant from ten to forty times as many as we wish to grow. Of course, all of these young plants consume part of the food needed for the growing of the crop. So much is lost. Then the chopping out tears the tender roots of the plants left. Often they fall prostrate and must be propped up to live and get a new start. In this way their early growth is checked. Besides

all this, damage comes in the cost of removal, generally quite an item, as farmers well know. These objections apply with equal, if not greater, force to other crops. Turnips, cabbage, clover, millet, and others are often seriously damaged by crowding. Just enough plants,

A HAPPY FAMILY.

and no more, is what we need to secure the best results. Study, calculation, experiments and care will be needed here.

There is one other important item to think about here: the value of the seed thus wasted runs annually up into the millions. About three times as many bushels of wheat are used for seed as is necessary to secure a stand. So with other grains. About forty

million bushels of cotton seed are wasted every time a crop is planted, just for the fun of paying to have the plants cut off as soon as they begin to grow. The waste here is about equal to the guano bill of the South. There would be as much business sense in collecting about six million dollars every spring from cotton planters and burning it. The same is true of the small grain crops. These things ought not so to be. Stop these great leaks in farm economy. Plant good seeds, just enough of them, and just right, so they will grow.

Shall we use fertilizers with the seed when planting? Generally it is well to do so. Small quantities of soluble food, ready for the tender roots as soon as they begin to grow, give vigor to the young plants. A little ammonia is very helpful at this period.

Do not plant too much. Overcropping is a fault with many young farmers. Eager to succeed, they plant more than they can give thorough culture. The expense in such cases may easily absorb the profit. A large crop may be gathered, and no profit realized.

A little farm well tilled,
A little wife well willed,
Give me, give me.

QUESTIONS.

1. Does planting require study? 2. What is the first to be considered? 3. Why? 4. What next? 5. What next? 6. Is labor to be considered? 7. Is the soil? 8. Is a single crop best? 9. For what shall we plant? 10. What will a wise farmer never do? 11. What is next to be studied? 12. Why is the right time so important? 13. Does this vary? 14. How is it with spring crops? 15. Should we observe the moon in planting? 16 Why not? 17. Do the moonites agree? 18 Do plants observe the moon's phases? 19. Why has this superstition such hold? 20 What should be done? 21. What is said about how to plant? 22. Is the depth important? 23. Is pressure important? 24. Do we need a good stand? 25. What is a good stand? 26. What evils come from overstand? 27. How do we plant cotton? 28. How is this hurtful? 29. Is the same true of other crops? 30. What do we need? 31. Is the value of seed important? 32. How much annual loss in cotton crop? 33. Is this sensible? 34. Does it pay to apply fertilizers when planting seed? 35. How much should we plant?

CHAPTER XVI.

SELECTING SEED.

There is as much difference in the varieties of seed as there is in the blood of horses. A valuable horse may sometimes spring from a scrub, but you can not count upon his doing so, and he will never sell for his value. The brand of his origin is upon him.

So you may sometimes succeed with ordinary seed, but you can not know you will. Seeds producing fruit after their kind are as old as the world. Their nature is to be true to their kind. Generally, improved seeds have a tendency to revert to the kind from which they were improved. This tendency is so well known that constant care is exercised by all seedsmen to counteract this. Seeds have been wonderfully improved by careful attention to well known laws of plant life. Good soil, thorough culture, and high manuring will often produce far better seeds than those planted. By selecting the best specimens of these and giving them careful attention for several seasons, they become set in type and distinct in variety. By persisting in this course, the possibilities of improvement are almost without limit.

Plants have male and female blooms or organs, and the pollen from the male of one plant is often carried by insects and winds to the stigma of other plants. In this way they grow a resultant seed hav-

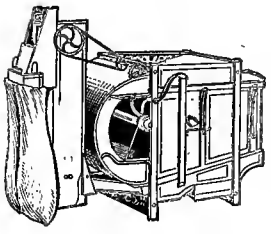
ing in part the properties of each. Such crosses very greatly improve some varieties, and often produce entirely new varieties.

These laws are so sure in their action, and so well understood, that experts produce almost any desired changes. The pollen from large varieties of corn will soon destroy pop corn entirely if they are planted near each other. The pop corn will have large grains, and will not pop. Okra and cotton can be crossed, and pumpkins and gourds will ruin watermelons. Now, from these well known facts we may draw some valuable lessons. Seeds may be greatly improved, or they may be entirely ruined, as they are crossed with higher or lower varieties. The soil that produces a poor variety will produce a good one just as easily. The manure wasted upon one may be saved upon the other. The same labor that produces a poor crop may produce a good one.

The *seed* may, and often does, settle the whole question of profit and loss on the farm. It is always found cheapest to use the best seed. Even in any given lot of seed, some are better than others. Using a sieve or fan, or otherwise separating the best seed, will be found to pay. All the light and chaffy seed can thus be removed. At the same time, many weed seeds that we do not want can be separated and destroyed. Purity of seed should be carefully guarded. Many diseases are carried from season to season on the seed. Smut and sometimes rust are carried this way. Washing the seed in a strong solution of bluestone will kill smut pores, and help to prevent rust

to some extent by insuring healthy stalks. Washing in water at one hundred and thirty-four degrees is said to have the same effect.

Again, all seeds have not the same germinating power. Be careful to select sound seed. A few seeds placed between two layers of cotton and kept moist for a few days will show what per cent. of the seed is sound. If you have not the cotton, a little moist soil will do as well. Every farmer can do much toward keeping his seed pure and good by careful methods of selecting on his own farm. In small grain, a few acres should be selected from which the seed is to be gathered. Before the grain is ripe, when in full head, go through this plat and with a knife cut out all spurious heads, leaving only those of the kind to be saved. Let these seed patches stand until the grain is fully ripe before cutting.



A FANNING MILL.

In corn fields, go through before the gatherers and select the best stalks, cut them, and keep separate. From the best ears on these select your planting corn. In selecting cotton seed very great care is needed. There are a great many varieties. Each has some merit, none have all the good points, very few are absolutely pure. Get the seed that gives you the best returns for your labor. Then go through the fields when in the best stage of opening, and select the finest bolls, and from these save your planting seed.

In this way you may improve any variety you have selected.

Thousands of dollars are yearly lost in the South by purchasing worthless seeds. Many of these we can grow better here. Irish seed potatoes grown and kept here are better than those we buy. By planting a second crop and saving seed from this, we will have the choicest. Beans and peas are suffered to rot in our gardens, and new seed is bought for the next crop. The seed bills alone of our Southern farmers and gardeners would add materially to our wealth if we raised the seed. Indeed, there is no good reason why we should not make thousands of dollars each year selling the seeds we are now buying. The climate is in our favor.

Of one thing we should always be sure. Seeds for planting should be thoroughly ripe before they are gathered.

QUESTIONS.

1. Show the importance of selecting seed. 2. What is the tendency of seed? 3. How is it improved? 4. How far may this be carried? 5. What organs have plants? 6. What results from crossing? 7. Are these laws known? 8. Give illustrations. 9. What may we do? 10. Show why profit depends upon seed. 11. How may we further improve seed? 12. How prevent some diseases? 13. What else should be done? 14 How may small grain be improved? 15. How may corn be improved? 16. How may cotton? 17. What do Southern farmers do? 18 Can they do better?

CHAPTER XVII.

PREPARING THE SOIL FOR PLANTING.

As we are now ready for planting, how shall we prepare the soil? Much depends upon previous work. If the heavy, deep plowing and subsoiling have been done in the previous summer and fall, we are ready to begin with harrows. On many farms this has not been done. King Cotton, the salvation and ruin of Southern farming, demanded our time and labor, and often occupied the very ground we now need for sowing wheat, barley, oats and rye.

We must begin at the beginning. About the first of September begin breaking the land deep with two to four horses, follow with a heavy roller and then with a harrow. This should be done before the sun and wind have had time to bake any clay lumps that were turned up. Repeat this until the soil is finely pulverized two to four inches. If stable manure was on hand for these crops, it should have been spread before the breaking, or immediately after, before the harrowing. Different harrows may be used in this work, according to the character of the work to be done.

Sow barley and rye as early as you can. Wheat should be put in during the latter half of October, and oats just after. All these grains should be harrowed in so as to be covered about one and a fourth inches. As none of these crops can be worked after sowing, the

preparations should be thorough. It is doubtful if drilling grain will pay in the South, except as a protection against winter-killing.

For spring crops we begin to prepare according to the condition of the land. If the land has much

A DISC PLOW.

vegetable matter on it, turn it under with two-horse plows, if the clay is not too wet. If spring oats are to be sown, put them in as early as practicable with small plows or harrows. Do not get them covered too deep. About one and a half inches is right. If corn stalks are on the land, run heavy rollers over them. This will break them down and at the same time so crush them as to greatly hasten decay. Never burn them.

To prepare land for corn, spread manure broadcast—heavily, if you have it, turn under and harrow. Repeat harrowing every ten days. When ready to plant, harrow nicely and plant with a corn planter. This is in every way better than bedding and planting either on the bed or in the water furrow. Make the experiment for yourself, and you will not need any argument to settle the question. Corn roots need a deep soil, and this preparation can not be too well done. By good work and heavy manuring it is just as easy to grow forty bushels per acre as ten. The heavier the yield, the cheaper the corn. If only chemical fertilizers are to be used, put them on broadcast, and do not be afraid to put them on. Only be careful to proportion the stalks left per acre to the manure used. Small yields of corn do not pay. Grow big crops.

How shall we prepare for cotton? Much the same as for corn. Remember that cotton has deep roots as well as shallow, and that in fruiting season cotton requires great quantities of water. So you must break deep and thorough. Bedding the rows for cotton is a mistake. Only one good can it do—make it easier to plow the first time—but subsequent plowing is more difficult, and often does vast injury by admitting direct sunlight to the roots and drying the ground when moisture is needed. Harrow nicely, and plant on a level. We must insist on one thing: Never plow, harrow or plant when your ground is wet.

There are many other crops, but it is beyond the scope of this book to enter minutely into the

details of all of them. The preparatory work for all is much the same. Deep, fine soil will help every crop. We can not insist on these two points too much or too often. They lie at the foundation of all success. Take a hard lump of loaf sugar and put a drop of spirits of turpentine on it. In a minute you can taste the turpentine anywhere you touch the lump with your tongue. It has gone all through it. Not only can you taste it, but it has softened the lump by pushing its particles farther apart. So, if you put your soil in such condition that capillary attraction can act fully, it will carry water through all the soil, and any kind of plant food that may be in one part will soon be evenly distributed through every part. Thus you have a uniform soil.

Market gardeners could not succeed at all with shallow plowing or with coarse, lumpy soil. The farm is only a large garden. What is good for the garden is good for the farm. Spread garden methods over the farm, and you make the farm a garden. The native soil is the same. Whatever difference there is, is the result of your work. The crops we have mentioned are the staple crops, and are what we may call the gross feeders. All the others, such as canes, melons, peas, fruits, vegetables, if there be any difference, require better preparation, because many of them are more delicate and more choice of their food. Thorough preparation always pays.

QUESTIONS.

1. Of what does this chapter treat? 2. How should it be done? 3. What often prevents? 4. How shall we prepare for grains? 5 When should they be sown? 6. How? 7. How prepare for spring grains? 8. How for corn? 9. Why deep? 10. How manure? 11. What shall we do for cotton? 12. Why not bed? 13. What do we insist upon? 14. What about other crops? 15. Give illustration of the value of good work. 16. What will result? 17. How do the farm and garden compare? 18. What conclusions may be drawn from these facts?

CHAPTER XVIII.

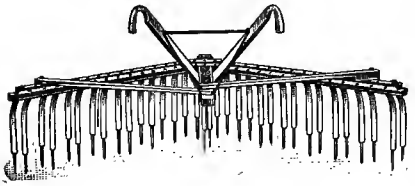
CULTIVATION.

The Tull theory, "Culture is Manure," has been well-nigh proven to be true. Under its magic touch, soils which have been thought very poor have proven very rich. If culture does not make manure, it certainly makes the manure do much greater good. By culture we mean stirring the soil so as to keep the top fresh, prevent all baking and destroy all objectionable growth. These hurtful weeds are so many and grow with such vigor that the farmer must be ever on the lookout for them. They slumber not, neither do they rest. By night and by day they spring up and choke the crop. There are not many crops that can be planted and left alone. They require constant help. As soon as the seed sprouts and begins to grow, noxious weeds do the same.

The warm sunshine and spring winds tend to form a crust on the surface, thus preventing free circulation of air, water and sunshine, all of which are needed to prepare food for the tender roots. So this crust breeds weeds and hurts plant roots. It must not be allowed to remain undisturbed. Rapid work is now demanded. The plowman's merry whistle should trill upon the morning air before the dewdrops have been kissed away by the sunshine. His mellow song of sweet content should wake the echoes after the roseate

sunset hues have passed away. Early and late he must speed the plow upon its mission of help and life. Care should be taken to injure the roots of the growing plants as little as possible. Hence light-running plows and harrows should be used. "Often and shallow" is the motto.

In this way the top of the soil can be made, as it were, a dust blanket. In this condition it acts in many ways for the good of the growing plants. It absorbs the sun's heat, but feeds it slowly to the root bed. It absorbs the dews, but prevents rapid evaporation. It assists in bringing up the earth water by capillary action, and at the same time prevents it from escaping into the air. In these and other ways it helps forward the rapid growth of the crops. The finer it is, the better it can do all of this work. Hence furrow after furrow is the price of success. Just before the corn comes up, run a light harrow or weeder over it. This will help to get a good stand, and destroy the first crop of weeds.



CULTIVATOR OR WEEDER

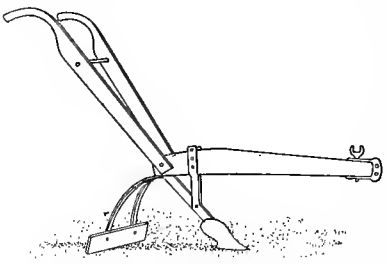
When the corn is a few inches high, repeat the harrowing. Follow with a hoe, thinning to a stand and leaving every stalk free to grow. About a week or ten days after, go over it with a cultivator or sweep. Continue this until the corn is in silk. For cotton the culture is much the same. If a crust forms after planting, go over it with a light harrow. This helps to let the

young cotton through, and at the same time kills the first crop, or coat, as we call it, of crab grass. This is the great enemy of the cotton plant. *Grass seed can not come up in freshly stirred soil.* There must always be a small or thin crust on the ground before crab grass will come up. Hence, we must stir the soil often and thoroughly to keep down the grass. When the cotton has been up long enough for the second set of leaves to appear, harrow thoroughly or plow close up with scrape, and chop out to a stand as rapidly as possible. The quicker this is done the surer the crop. Very many object to this statement, but a long experience is on this side.

Give early vigor to the cotton plants, if you wish to be sure of a good crop. Late cotton sometimes succeeds, but, whether planted early or late, as soon as the plants come up every effort should be made to hasten their growth. When brought to a stand, a plow should follow, throwing a little soil to the roots of the cotton. If the work has been well done so far, the crop is well-nigh safe. If we have destroyed all the May grass and secured a good stand, and only a stand, rapid use of cultivators will do the rest. Always keep the midd e of the rows clean and fresh and level. Deep middle furrows are always hurtful. A little work with hoes will be needed, and should be promptly done. Delay here is costly and dangerous. Continue this culture until the first bolls are about grown. Of course, these directions are necessarily general rather than specific. Soil conditions and previous culture will often modify plans. Fresh

land, stumpy fields, stony fields, cotton after stubble, or cotton after cotton, will greatly change the conditions. Common sense must be used by the farmer.

The general principle is, keep the field clean of grass and weeds and stir the soil often and shallow, not over two inches after the blooms appear. After this period the feeding roots spread everywhere in the soil. Never break these purposely. What we have said about these two leading crops of the South is largely true of all other crops. Farmers are often tempted to stop plowing during a drouth. This is a mistake. The drier it gets, the oftener your dust blanket should be stirred, and the finer it should be made. Peas and sorghum cane do not need much culture. Melon vines should not be moved after young melons appear. Root crops, such as beets, turnips, and potatoes may be plowed deeper than crops which fruit above ground. Gardens and truck patches require very rapid and thorough culture. As a rule, the greater yield you expect, the oftener you must work.



A DUST BOARD. ONE SHOULD FOLLOW EVERY PLOW.

It is an old adage that "a stitch in time saves nine." Nowhere is this more true than on the farm. "A lick in time and a lick every time," should be the farmer's motto.

QUESTIONS.

1. What of the Tull theory? 2. What is culture? 3. Why needed? 4. Why should it continue? 5. What should be heard? 6. Why cultivate shallow? 7. What does the dust blanket do? 8. Should it be fine? 9 Give culture for corn. 10. Give culture for cotton. 11. Why should this be early? 12. How should we continue? 13. How about middles? 14. Are these directions specific? 15. What may cause variety? 16. What is the general principle? 17. Should dry weather stop us? 18. Tell about other crops. 19. Tell about the garden. 20. What is the farmer's motto here?

CHAPTER XIX.

GATHERING AND HOUSING.

"The laborer is worthy of his hire," and so we find that seedtime is followed by the harvest day. There is more pleasure in the ingathering than in the outlaying. The harvest feast and the harvest song are as old as history. The sweltering days give rich reward. The small grains will come first. When the golden tint is well set and the firm grain is in the head, the mower, reaper, sickle and scythe are heard in the land. If the grain is for hay-feeding, cut just as the dough stage is reached. If for grinding, then it should be fairly ripe. If for seed, then thorough ripening is best. Grains, wheat particularly, make whiter flour if reaped before too heavy a coat of bran is formed. Local surroundings will decide whether the reaping shall be done by hand or machine.

After the grain has been placed in dozens and well capped, it should stand until thoroughly dry, if the weather will permit. If you are dependent upon the traveling thresher, it is well to have plenty of barn room. In such cases it is always safe to house as soon as dry enough. Storms or continued rainy spells can soon ruin or greatly damage the crop. Here "an ounce of prevention is worth a pound of cure." Some find it cheaper to provide weather-caps of duck cloth, each corner weighted, and put these over the

shocks or hand stacks. They save the hauling and attendant waste and handling. The straw is getting too valuable to lose. Taking care of the grain will also take care of the straw until the thresher comes. If the straw is to be fed to your cattle, a straw rack will be a great saving. Build a long shelter and board it cheaply. Have it about thirty feet inside and about nine feet high. From the middle have peeled pine poles, placed about four inches apart, and ending about three feet above the ground on either side. Have an open driveway, about eight or ten feet, running entire length. On either side of front, build a chaff room. Have a floor six feet wide running along over the wagon way.

Place the machine so that the straw will be discharged by the stacker on the six-foot floor. A man with a fork can easily distribute it along on the poles on either side. When the threshing is over the straw and chaff will be ready for feeding, without more handling. Light gates or doors can be used, if desired. The cattle can feed themselves at night and be shielded from all bad weather. The manure will be dry and ready for the field. Any kind of hay may be thrown into this rack. It is a great labor-saver as well as food-saver. The grain should be at once placed in rat-proof, weavil-free bins. A little care will so build them that rats can not get in. If the grain is dry and kept so, weavils are not apt to appear. Heat hatches them and moisture creates the heat. A little air-slacked lime sprinkled over the grain will absorb the moisture, and help to prevent weavils.

A bottle of carbon bisulphide, left unstopped, will drive the flies away and kill the eggs. As carbon bisulphide is highly inflammable, it should be placed in a box and secured so that it will not be spilled.

Keep dry and cool and all will be safe. A good grain house is an essential part of a farm.

For corn-gathering a good many ways have been recommended. Fodder-pulling has been a regular part of farm work, but we have learned that hay is cheaper than fodder, and in every way as good. We have also learned that the stalk is as good for hay as the blade. The increased value of the hay resulting from using stalks as well as blades is leading farmers to quit pulling fodder and corn in the old way. We note when the grain is beginning to harden and the fodder is fully ripe, but not all burned, and then cut the stalks and stack them in fields four weeks or more. When the corn is dry we haul it in, and with a shredding machine shuck off the ear, and grind the stalk, shuck and fodder into hay as good as the fodder alone, and three times as much of it. Animals eagerly devour this hay, and do well when fed on it.

We have thus saved a great deal of labor and expense, and gathered a much larger crop of food from the same area. This plan is new in the South, and will be somewhat slow of adoption. The cost of shredders, and engines to run them, is the chief difficulty. This can be met in two ways. Either club together and buy one outfit for several farms, or let the man who runs the traveling threshers run a traveling shredder. The corn stalks are worth as much as the

corn. Why, then, should we lose them, as we have been doing? Saving is as important as making, and often much easier and more profitable. Bale the hay and care for the corn, and you will have a larger clear gain. But if you prefer the old way, the fodder should not be pulled too early, as it is the lungs of the corn plant, and stops all work in the stalk when taken off. Pulling fodder always makes the grain lighter. Put the corn away in the shuck, a little damp, mix in a little lime to keep rats out, and use carbon bisulphide for weavils. The annual loss from rats is enormous, running up into millions of dollars. Build good cribs, rat-proof, and then use *rough on rats* and keep plenty of *cats*.

As to gathering cotton, but little need be said. The growth of the lint bursts open the bolls. This growth continues for several days after the opening. Picking cracked bolls is not wise. If the weather is good, this growth will be finished in three or four days. There is no gain in leaving the open cotton after this. All chances considered, it is well to keep up with the picking. The handling after picking is quite important. The common custom of putting the cotton in the wagon as it is picked, and unloading it at the gin, is objectionable from several points. The cracked bolls being still damp, the lint will be cut off in lumps, and the sample will be either gin-cut or nappy, or both. Such bales never bring the highest market price. Add to this the trash due to careless picking, and you have one cause for the loss of millions of dollars every crop.

Careless packing causes another line of losses. There is no more unsightly thing thrown upon the market than the average bale of American cotton The known uncertainty as to uniformity of quality necessitates repeated samplings. Each of these leaves an ugly scar, and causes a loss of weight. The size and weight make the bale awkward to handle, and the rough, heavy covering not only catches all sorts of filth, but is worthless at the factory, and is deducted in pricing. All these causes result in a loss of about two dollars and seventy-five cents per bale. With a ten million bale crop this would mean twenty-seven and a half millions of dollars. This vast sum could be saved by changing the method of baling. It is hard to change a well established custom, but when about one-tenth of the value of each crop is lost, it is worth while to do something. The round-bale system claims to do this, and is certainly worthy of the careful study of every cotton planter. Another fearful loss is caused by the old method. Having no suitable cotton house, and carrying the cotton directly from the field to the gin, encourages the idea of carrying the bales from the gin to the market. In this way the cotton crop is annually sold on a forced market, while the staple is known to be green and damp, and constantly losing in weight. The buyer must defend himself against all of these detriments, and hence the bulk of the crop always passes from the producer's hands much below its real value.

As it requires twelve months to spin, weave and consume a cotton crop, so it should require twelve

months to sell it from the producer's hands. This rapid, forced sale costs the farmer about one cent per pound, or about fifty millions of dollars every year. This is no guesswork or fancied statement; it is an actual state of affairs: the direct result of the farmers' mismanagement in gathering this great crop. Thus we see about seventy-five millions of dollars lost on each cotton crop. This money we had made, but failed to put in our pockets. It is certainly time for farmers to educate their boys and themselves to better methods in gathering and caring for their crops.

We can not enter minutely into every little side crop. Local surroundings will generally guide in caring for these.

The sweet-potato crop is one of growing importance. To save the potatoes is often a matter of concern to the grower. We should be careful not to dig them before they are ripe, nor can it do any good to leave them in the field after maturity. It is a mistake to be governed entirely by regard to frost in the matter. By cutting a potato and letting it dry, and noting the color of the dried milk, we can tell whether it is ripe. If the milk dries white, they are ripe, otherwise, they are not. When this is the case they should be dug, regardless of frost. Many methods have been tried for preserving them after gathering. We shall not select among them. Remember the nature of the potato and act accordingly. They are full of water. Much of this must escape or they will not keep. Never cover them closely until most of this water has been dried out. Soon after heaping them they will get very warm

in the effort to throw off this excess of water. When this sweating is over, you may cover them with any convenient covering, as earth or cottonseed, or put them in a warm cellar. They are very easily injured by cold and must be kept warm. First dry, then warm, and they are safe. A little vegetable heat will be developed every warm spell, so a small opening should always be provided for its escape. In extreme cold spells this should be closed.

Irish potatoes form another valuable crop. They differ in their nature from sweet potatoes. They are not easily affected by cold, but are strongly inclined to sprout if warm. The two essential points in keeping them are: First, keep them in the dark; second, keep them cool. Light causes them to sprout, and in this condition cold ruins them. Prevent this, and they are very hard to freeze. All bruised tubers should be removed a few weeks after digging. They may be kept in boxes or barrels, in the barn, covered with hay, or in the hills like sweet potatoes, but with lighter covering. A moderately cool, dark room may be cheaply built for them.

These two crops may be made to save several millions of dollars to Southern farmers.

QUESTIONS.

1. What thought begins this chapter? 2. What harvest comes first? 3. When do we cut grain? 4. How? 5. What next? 6. What should be plentiful? 7. What do some prefer? 8. Should straw be saved? 9. How can this be done? 10. Describe straw rack. 11. How is straw put in? 12. What advantages? 13. What should be done with grain? 14. How may weavils be kept out? 15. Is a granary needed? 16. Shall we pull fodder? 17. What is better? 18. How is shredding done? 19. What do we save by it? 20. What is the chief difficulty? 21. How may we do it? 22. What are stalks worth? 23. If we pull fodder, how? 24. How should we care for the corn? 25. How should cotton be picked? 26. How handled afterwards? 27. What objections to present form of bale? 28. What do we lose by it? 29. What improvement is proposed? 30. What other source of loss at the present? 31. How do we sell? 32. How should we sell? 33. What are we losing? 34. What is the total loss from these two? 35. What should be done? 36. When should sweet potatoes be dug? 37. How cared for? 38. How should Irish potatoes be kept?

CHAPTER XX.

MARKETING CROPS.

Making crops is one thing; selling them is quite another, and often a more important one. The genial climate and generous soil of the South make it an easy thing to grow good crops. Very little skill is required to grow cotton, but, as already said, the selling to advantage is quite difficult.

First of all, we need to know where we can sell to best advantage. This is a matter of first importance with all perishable products. One city may be oversupplied and prices dragging. In another there may be a scarcity and good prices may be obtained. Early in the season, when the first grapes are ripening in the South, they bring fine prices in the North. Later, when Southern grapes are all gone, and they are ripening in the North, the Northern markets may be overstocked and dull. At this time the Southern markets have no grapes and will pay better prices for them. Sell where there is a demand for your goods. Keep posted, that you may know Often we will need others to sell for us. Generally, this is done for a commission or part of the sales. If commission men are honest, they can save you money. They have the time to know and to look after the sale. You are compelled to look after your produce, gather and ship. You need his services, he needs your produce.

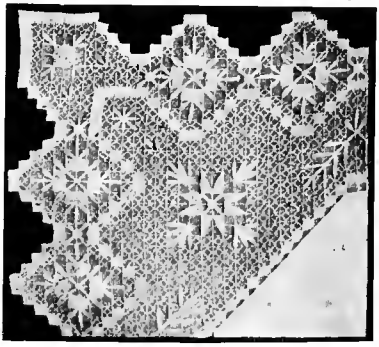
It is profitable to both to co-operate, but there is opportunity for cheating.

You must depend largely upon your merchant in such cases. It is best to deal with persons of such reputation that they can not afford to be dishonest for the profit in your business. If there are buyers in your market, it is safe to sell at home. It is generally well to sell as soon as you well can. Cotton is about the only exception to this rule. It is the farmer's business to grow and sell. It is not often his interest to hold. In perishable crops this is particularly true. In spring fruits and vegetables, the first always get the fancy prices. The preparation of produce for the market is a point of first importance. A wagon load of strawberries in bulk would be almost worthless. Packed in quarts and crated, they would be worth from fifty to eighty dollars. One man takes a load of sweet potatoes as dug from the field, and finds slow sale at low figures. His neighbor selects only good-sized potatoes, washes them and puts them in half-bushel packages, and gets good prices and finds a rapid sale. These are perhaps two extremes, but they show the point. Corn may be very plentiful and worth fifteen to twenty cents per bushel. Hogs may at the same time be in demand at good prices. One man sells his corn and is discouraged with farming. His neighbor feeds the corn to hogs, sells at a good price, makes clear money, and is happy and thinks farming profitable. Hay and grain may be dragging. Cow's milk and butter may be high. Turning the crop into live stock is simply preparing the goods for the market.

There is money in it. Always put your produce in such shape that will cost the least freight and bear the highest price per pound. Thus, you may have a few cows. There is no market for your milk and butter. Your neighbor is perhaps in the same condition. Get together, form a stock company, build a creamery, and you have a market for all of you.

THIS IS HOW WE SELL IT.

Always put your produce in the shape most attractive to the eye; for most purchasers are guided by first impressions. The Italian fruit-dealer understands this part of human nature, but he seems to utterly ignore the same principle in his personal appearance. The first of his kind to gain a foothold here will coin money.



THIS IS HOW WE BUY IT.

In all things intended for food, you can almost create a market, or control it, by offering only the best for sale. Strictly choice fruits, vegetables, butter, and other such farm products have never found a crowded market.

Many consumers have plenty of money. They do not care for the price, but they do care a great deal about quality. If their taste and fancy are pleased,

they will not hesitate at the price. A strictly fine peach, rosy-hued and full of luscious juice, will demand fair figures even when ordinary peaches are going for a song. Perhaps the largest loss is found in offering our produce in bulky and cheap form instead of putting it in a higher-valued shape.

Take lumber. We lose immensely by selling it in rough shape from the saw, instead of working it into the thousands of shapes that the people need. A log may be worth a dollar; in singletrees or ax handles ten times as much. In finer furniture the value would be still greater. It must come into these shapes at last.

Iron is worth in pig about ten dollars per ton; in nails about fifty dollars, and in needles and knife-blades about one thousand dollars per ton.

Cotton is worth in the seed about two cents per pound. In lint it brings six and up. In thread it would bring about twelve to twenty cents. In cloth from fifty cents to a dollar. Why sell it in the rough, bulky, cheap lint bale? You say we would cease to be farmers and become manufacturers. So we would, and so we should. We should put our goods in shape to bring the highest value. We have as good reasons for spinning as we have for ginning. There is no reason why we should forever tread the dusty plow furrows and enrich the world in the sweat of our brow. Farmers should think and act. If cotton is king, cotton growers should be princes.

QUESTIONS.

1. Why should we know how to sell? 2. What is the first point? 3. How are the early markets for grapes? 4. Do we need commission men? 5. What risks do we take? 6. What is safest? 7. When should we sell? 8. Why? 9. Is appearance worth anything? 10. Illustrate in the case of strawberries. 11. Potatoes. 12. How does corn pay best? 13. Hay and live stock? 14. What should we do? 15. May we create a market for milk? 16. Shall we please the eye? 17. What will always pay? 18. Where is there a large loss? 19. Show this in lumber. 20. In iron. 21. In cotton.

CHAPTER XXI.

INVESTING PROFITS.

With poor farming there may be no profits. With good farming there will always be some profits. The farmer who knows how to farm will make money. The laws of the vegetable kingdom are definite, and can be depended upon. "Some thirty, some sixty, and some an hundred fold," is not figurative language. A grain of wheat often produces sixteen hundred to two thousand grains. A grain of oats will often produce as many as forty heads and each head eighty grains. In good ground and with plenty of room they produce sometimes one hundred heads from a grain. Here we have from three thousand to six thousand. One oat grain has produced, by actual count, sixteen thousand, three hundred and eighty grains. One watermelon seed will produce several thousand seeds. Mustard, turnips, cabbage, beets, and others of these, produce thousands from one. One cotton stalk, from one seed, has borne six hundred and forty mature bolls, each boll containing from four to five locks. Each lock had nine seeds. So we have $9 \times 4 \times 640 = 23{,}040$ seeds. It is quite common for one seed to produce two thousand. So we see that the farmer has a wider margin of increase than any other man.

The farmer needs only to watch the expenses and losses to get along well. What shall he do with the

profits? What has he been doing with them? Look at your cities and ask whose money built them. Look at the railroads and ask the same question. Look at your banks and find where the money came from. There is a constant stream of people moving from the farms, carrying their earnings to the city. Farmers build the schools and pay the teachers. Very much of

A BEAUTIFUL HOME.

this they do in the ordinary way of human business life. But many farmers of set purpose invest their money in any and everything except building up their farms.

All surplus money should go back into the farm in such a way as to build up and improve it. There are many ways to do this. Get better tools, so that you can do better work. Buy better stock, and thus improve your herds and stalls. Use more manure,

better culture, and improve your soil. Build better houses. Add to your household conveniences, so as to lighten the housewife's work. This is not extravagance. The farm is your capital. You only enrich yourself when you add to its value. Farming is your business. Improving your farm is adding to your business. You get larger returns from every improve-

A PROSPEROUS FARM YARD.

ment. The farm is your bank. If you increase your deposits, you can draw more upon it without risk. The farm is your home. The more attractive you make it, the greater will be your enjoyment of life. It is your wife's abiding place. You should use every effort to make her happy. Here your children grow up. If home life be happy and youth be joyous, they will abide with or near you in later years.

Buy good books, musical instruments and paintings. Cultivate the minds and eyes of your children. Keep

good chickens, fat pigs, colts, calves, and lambs. Cultivate flowers and fruit trees. Teach your children industry and economy, but not toil and stinginess.

I have seen a farmer, brown and sunburnt, get into his rattletrap buggy, with tied-up harness, holding a hickory stick to beat the ill fed bones, without overcoat or umbrella, drive off to town to look after his storehouses, bank buildings, railroad stocks, and such investments. Behind him he left a tattered house, paint gone, blinds hanging, panes out, yard fence down, flowers eaten up by cows, and so on. As soon as his children grew up they left the farm, and the best of all his investments was gone — gone to the overcrowded city, reeking with vice and sin; gone to be swallowed up in the passing throng, rushing on to ruin; gone from the farm and a mother's broken heart. Such men make a wrong investment of their profits.

The best possible investment a farmer can make is to leave behind him a better farmer, to enjoy a better farm. Make a happy home, and leave it to happy children.

QUESTIONS.

1. What is the subject of this chapter? 2. Should there always be a profit? 3. Why? 4. How many grains come from one wheat, oat, melon, or small seed? 5. How many from cotton? 6. What do these give the farmer? 7. What has become of his profits? 8. What should he do with them? 9. How can he do this? 10. What is the farm to the farmer? 11. What will result from this cause? 12. Describe what we sometimes see. 13. What follows this scene? 14. What is the best investment?

CHAPTER XXII.

FARM LABOR.

The class of labor that can be used on the farm differs very much in different parts of the country. We write of the labor of the South. We have very peculiar surroundings here. We must write of things as they are. We might like them to be different, but we must do what we can with them as we find them. Negroes constitute a very large part of our population. They were made free citizens by the result of the war between the States. Without any previous training, they were made self-supporting free men in theory. In reality they have never become self-supporting. They had no knowledge of anything except farm work. To this they had been reared, but they were in no sense skilled farm laborers. The white man had always done the thinking for them. From the very necessities of both races, the negro has been the farm laborer of the South. He knows nothing else, and we can use him in no other way so well. He loves city life. Idleness and company are congenial to his nature. From hand to mouth suits his genius. But the most of his kind are on the farms. How shall we use him, has been and is the vexing question. There are three principal ways of dealing with him:

First.—Working on shares. Under this system the landowner furnishes the land, the stock, the tools,

and the feed for the stock, and the seed for planting. He also provides a house, rent-free, furnishes firewood and water. The laborer only furnishes the work. He feeds himself and works the crop. The crop is divided equally after paying for the guano, ginning, and bagging and ties. It is clear at a glance that this is a one-sided trade. The landowner risks everything. The laborer risks nothing. In the large majority of cases the latter has no supplies for himself and family, and no credit. The landowner must furnish these and take the risk of getting his pay out of the crop when it is gathered. In such cases the laborer collects and consumes his share of the crop day by day before it is made. He runs no risk whatever. If, from any reason, providential or otherwise, the crop should fail, he has already gotten about what it was expected to make with a good season. In thousands of instances he has fallen behind at the end of the year, and the landowner had no way of making himself whole.

A GROUP OF LABORERS.

The laborer was under no obligation to stay and try to do better. If he staid, he generally did worse the

second year. So he has packed up and gone to do some stranger the same way the next year. Millions have been lost in this way every year by Southern farmers. Many of them have lost their farms. This system, with slight modifications, is still practiced by a great many, simply because they do not see their

A TENANT HOUSE.

way clear to do otherwise. It is objectionable from almost every standpoint. It is a partnership with no community of interests, no equality of risks, and no guarantee to the party furnishing everything. Under this system the laborer sells his labor high. Many shrewd young white men have seen this, and soon made enough money to buy out the landowner. This vicious system is one of the great drawbacks to prosperity among Southern farmers. It offers a premium to laziness, theft and all sorts of bad farming. It

would not live if we were not land-poor. We think we must work all the land, but in these cases the land had better be turned to grass. Yet this numerous class produce a large part of the enormous cotton crop which keeps the price down. They know how to grow cotton. They know nothing else. They can divide this, sell and be gone.

Second.—The next system is the renting of land for part of the crop, or for so much money. The large majority rent for cotton. A one-horse farm, from thirty to forty acres, is rented for two bales or one thousand pounds of lint cotton, of middling grade. This price was considered about fair when cotton was bringing about ten cents per pound. A two-horse farm rents for two thousand pounds. The renter is expected to furnish himself and family and the horse-power, guano and other expenses. In very many cases, however, the renter has nothing and no credit, and the landowner must furnish him everything or stand responsible to the merchant who furnishes him. So the entire risk falls upon the landowner at last. If the crop fails or falls short, the renter is not hurt. The owner must bear the loss. This very often occurs. With cotton selling at four to five cents, the land will hardly pay taxes and keep up repairs. It is a serious question, whether to go on or stop.

This system was adopted when prices were up. It is ruinous when prices are down. But it is hard to change customs. The low price hurts the tenant also. Some prefer to rent for part of the crop—say one-third of the grain and one-fourth of the cotton. This seems

to distribute the risk more evenly, but here, as elsewhere, the furnisher generally has the burden to bear. Our laborers are so shiftless and own so little that they can rarely lose their part of the loss. The sharer or renter represents the labor. If he is a good farmer, active, industrious, and honest, these plans may work very well. All depends upon the man. Very little upon the land. Experience shows that the large majority of the renters under either of the above systems care nothing for the landowner's interest. It is all the same to them if the land washes away and fences fall to decay. They lose nothing if the houses rot down, or the ditches in the lowlands all fill up.

In the inefficiency of the labor lies the chief cause of the poor farming of the South. Land is plentiful and cheap. The careless laborer knows he can easily find another home. The less character he has, the more promises he is willing to make; hence the trifling class often get the best homes. Farmers have not yet learned to require certificates of character from those who want their land. If they could reach a concerted plan of action, requiring every renter to show that he has settled squarely with former employers, a new era would dawn upon Southern farming.

Third.—The last and least used plan is to hire the laborer for stated wages. The landowner then gives personal attention to the farm. This plan is the best from every consideration. The owner's eye and brain direct everything. The laborer is paid for what he does, and is sure of his pay. Both parties are stimulated to do good work. The owner keeps up his houses,

fences, ditches, levels, and tools. Every detail is looked after. The laborer is cheerful and obedient. An air of comfort and prosperity is apt to prevail. These are the men who are making money, as a rule. Why, then, does not this system prevail and the others fall into disuse? The causes are numerous and hard to overcome.

THE FARM DESOLATE AND FORLORN. THIS DRIVES THE BOY FROM THE FARM.

Very many of our landowners do not live on their farms. They prefer to live in the cities and villages, and to follow other pursuits. Many of them know but little about farming, and care less. They rent for so much, exact the rent, and care but little how it is produced. Many of them had once lived on their farms, but for want of church, school, and social privileges they have left them. The two leading causes of this condition are—too much land

and too many negroes. The negroes, as already said, furnish the largest part of farm labor. The man who works his farm for wages must depend almost entirely upon negroes for labor. Hence his dealings and associations must be largely with them.

THIS DRAWS THE BOY TO THE CITY.

If his children are brought up to work on the farm, they are thrown in daily contact with negroes. This state of affairs is not congenial to white people. The two races do not and can not mingle socially, so the white man goes to town and leaves the negro to run the farm. This is a disagreeable truth to face and to state, but it is a reality. While it remains, Southern farming must suffer in every detail.

Perhaps, after all, one of the leading troubles in this and every system of labor with us is the want of technical education among our farmers. Farm life has not been found attractive by our brightest and best young men. General education has not fitted them to succeed on the farm, and they have gone into other pursuits. Farming has been left to chance. The wonderful discoveries and advances made in Agriculture have not been taught to our farmers. Hence they are behind. We need to realize that farming is a science as well as an art, and that both the science and the art can be taught and learned. We are criticised and blamed for many things for which we are not to blame. Our surroundings and the difficulties growing out of them are not understood. The difficulties of our labor system are at the bottom of all of our failures. When these shall have been fully adjusted, the South will enter a new era of prosperity; our storehouses of farm possibilities will be thrown open, and our fair land will bloom as a garden.

QUESTIONS.

1. Is farm labor the same everywhere? 2. Why is Southern labor peculiar? 3. What sudden change? 4. Why is the negro necessarily a farm laborer? 5. Is he skilled? 6. What is the vexing question? 7. What is the share system? 8. Why is it one-sided? 9. What must the owner often do? 10. What result in thousands of cases? 11. Why do we continue it? 12. What are the objections? 13. What else results? 14. What is the renting system? 15. What should the renter furnish? 16. What does he furnish? 17. What often results? 18. How do some rent? 19. What is the usual experience? 20. What is the cause of poor farming in the South? 21. What should be required of renters? 22. What is the third system? 23. Why is it best? 24. What does the owner do? 25. What results? 26. Why does this not prevail? 27. What are the two leading causes? 28. Who are the wage hands? 29. What is the result upon the whites? 30. What is the leading trouble? 31. What kind of education is needed? 32. Can farming be taught and learned? 33. What lies at the bottom of bad farming in the South?

CHAPTER XXIII.

FARM IMPLEMENTS.

The plow is, and ever must be, the most important farm tool. The ground must be broken up before we do any other farm work in the soil. All that has been said about preparation and culture includes the idea of the busy plow. Plows are made to do different kinds of work. They may be found of every sort and shape, from the forked stick to the sulky cultivator. The idea is, power in front, a man behind, and a tool for tearing the soil between. The ancients used a wooden fork with a tip of iron on it. Such plows are still in use among uncivilized nations. Sometimes this rude machine is pulled by man power. In many countries oxen are used. The mule is in the majority, but in many places steam engines are now used to move the plows. The kind of plow used is a pretty fair index of education.

When the object is to simply loosen the soil, the common rooter has been almost universally used. When the soil is covered with vegetable matter which we wish to mingle with the soil, then we use the turn plow. All soils not being the same, the same plow does not do equally good work everywhere. Hence, we have a variety of shapes given to the wing, or turning part, of the plow. Hundreds of different turn plows

have been patented. It would be difficult to choose among many of these. This is not our object.

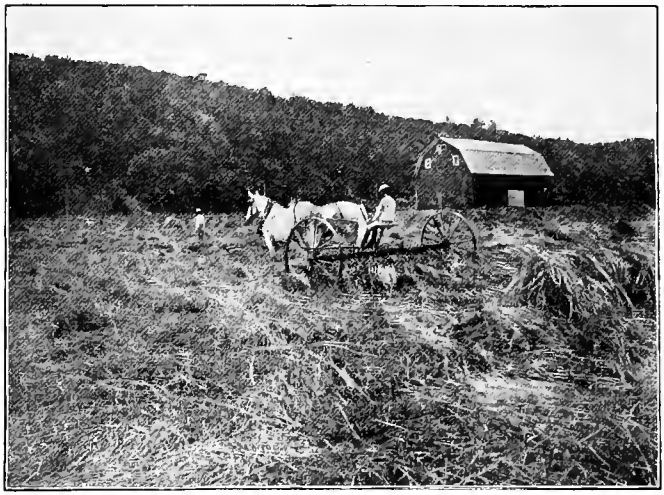
What we wish to insist upon is the use of a good plow. Much attention has been given to getting a plow which will do a given amount of work with the least draft upon the team. Plows differ greatly in this respect. Some force the ground apart by main strength. Others cut and turn it scientifically. Some twist the roll of sod partly over. Some turn it entirely upside down. Sometimes you wish to do one way, at other times the other way; but be sure to have a good plow, whether you wish to do one way or the other.

Plows range in form from the Chinaman's wooden stick, with its iron tip, to the Welchman turn plow, which, by going twice around in the same furrow, cuts twenty-six inches deep. Get the best one, two, four or six-horse plow and use it so as to get and keep the greatest possible depth of soil. In this way you pave the way for other improved implements.

Harrows are plows with many small blades, for shallow work. Here again we have an almost endless variety. Every conceivable shape and combination has been tried, from the wooden beam, with a few pegs driven in, to the steel frame with elastic steel teeth. Perhaps you will need several of these. Some to scratch, some to smooth, and some to cut. The object generally is to make fine the soil turned up by the plow. This work can not be done too often or too well.

To make dust of the soil is desirable and profitable. Often we need harrows to break the crust and destroy weeds and grass. They are great labor-saving

A BINDER AT WORK ON A SOUTHERN FARM.



MAKING HAY.

machines. They enable one man and one team to do the work of several. Some harrows are so made as to be used in covering grain, and enable the farmer to do this very rapidly and nicely. Sometimes they have seeding and guano-distributing attachments. These machines do the work of several hands at once. Those of another form are called cultivators, and are so constructed as to greatly simplify the work of cultivating many of our crops.

Planters have almost entirely done away with hand planting. They do the work more rapidly, accurately and cheaply than can be done by hand. They are so constructed as to put seed all along in a continuous row, or drop them at any required distance in hills. By using different attachments, some of them may be made to plant almost any kind of seed.

Manure spreaders are so arranged that they grind up or tear to pieces the coarse barnyard manures and distribute them quite evenly over the fields. The work is much better done than can be done by hands and forks. Here, as in all good machines, there is a great saving in labor.

Mowing machines, horse rakes, hay tedders, stackers and unloading conveniences are so well known and appreciated that we need only mention them as a part of the march of progress on the farm. No farmer would think of harvesting a large crop of hay by hand. Hay presses make it possible to handle hay with great ease, and greatly reduce the storage room required, but a cheap power press is still much to be desired. Inventive genius has done wonders in solving the

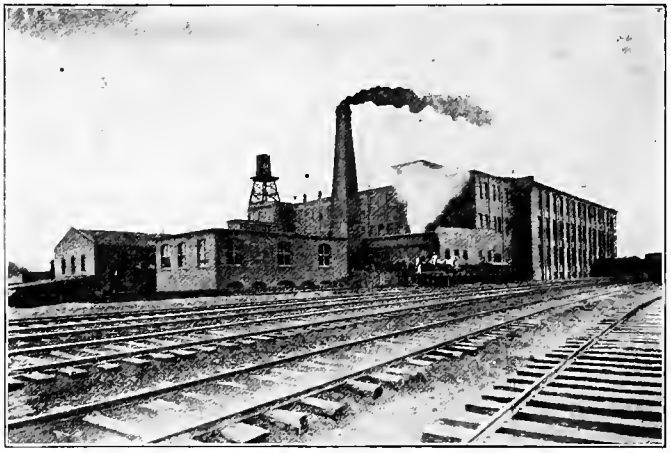
A CORN HARVESTER.

question of handling small grain. From cutting with the hand sickle, separating with the flail, or horses' feet, and winnowing with the wind, we have advanced until now the grain is cut by the self-binder and delivered ready for the shock, or cut, threshed and sacked ready for the miller. These wonderful machines are run by self-traveling engines, propelling themselves and the machinery. These are used only on large grain fields. Yet they are a part of the farm equipment possible, and affect the price of the grain produced. The handling of the corn crop is being greatly simplified. Instead of the labor of pulling the fodder and ears by hand, shucking and shelling in the same laborious way, the machine does it well-nigh all. The stalk is cut and fed to the shredder. This machine takes off the ears, shells and sacks the grain, and shreds the stalk, shucks and blades into excellent hay.

In gathering and preparing cotton for the market, comparatively little advance has been made. We still pick it by hand, gin it with saw gins, and bale it in rude packages, unwieldy and unsightly. Many machines have been invented claiming to pick cotton. So far they have failed. Efforts are being made to separate the lint from the seed without cutting, but the problem is not yet solved New processes are being tried for the improvement of the bales. Inventive genius may yet succeed along these lines. As soon as the cotton leaves the producer's hands, all this is changed. The huge compress takes the bale in its embrace, and hands it out reduced in size. Thus the railroads and ship companies can carry three times

as many, and the cost of transportation is thereby greatly reduced. When we enter the cotton factory, we find ourselves in wonderland. Marvelous machines, that almost seem to think and speak, manipulate this fiber of the farm into a thousand useful fabrics.

So we find at every step, from the hoe handle to the steam thresher, improved machinery which enables



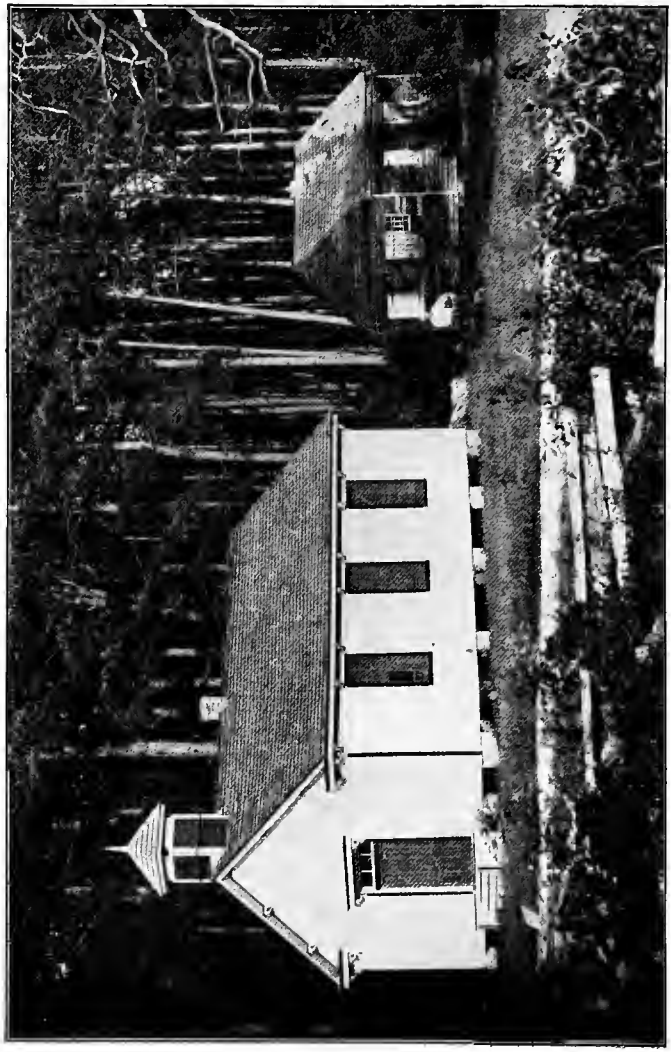
A FACTORY.

the farmer to cut down his expenses, do better work, and run up his profits. It would be just as sensible to expect the traveling public to abandon the Pullman sleeper for the old-time lumbering coach and six, as to expect a farmer who understands his opportunities to continue his old way of farming. The manufacturer could as well afford to exchange the spinning jenny and power loom for the old-time hand spinning wheel

and hand-shuttle loom, as the farmer of to-day can afford to ignore the mower and reaper.

The author of this little book remembers helping, in his boyhood days, to build the rail pen and spread the grain thereon, and blistering his hands beating out the grain with a hand flail. How he enjoyed riding the horses around and around when the treading yard supplanted the rail pen. Then came the simple thresher and winnowing fan; next, the traveling horse-power thresher; then the steam engine and separator. He has served his day with each of these. If such wonderful improvements have been made during one short lifetime, what may we not expect in the days to come. Young farmer, keep up with the procession. You can not afford to be left behind. Conservative men always abound. They are more numerous among farmers than any other profession. This grows out of our isolation. We must not listen to doubters and croakers. "Prove all things. Hold fast to that which is good." In no field of human enterprise has inventive genius done more in the last half-century than in the improvement of farm implements. Use the best in every line.

Tools left out in sunshine and rain lose, in a few years' time, more in value than it would cost to build a shelter. The wooden parts very soon begin to decay. The iron and steel rust, and are thus injured. The oxygen in the air is no respecter of men or tools. Its gnawing tooth is never idle. A little care spent in keeping tools of all kinds well painted, will be found to pay well. This is particularly true of the wooden



THE OLD-TIME SCHOOL, AND THE NEW ONE.

parts, but often applies to the metal also. No skill is required in doing this kind of painting. The paint can be purchased ready mixed, of any desired color. Anyone can put it on. It will pay to do this about once a year on tools that are much used. This work can be done on rainy days, or other odd times, without interfering with the regular work.

It requires more human strength and animal power to do sorry work with a sorry tool than it does to do good work with a good tool. We do not advise buying everything new that is offered, but when a tool has been tried and proven to do more work or better work, or both, if the price is reasonable, you want that tool. Always require a guarantee that the machine will do what it claims to do. The market is at all times full-stocked with failures and humbugs. Farmers have caught their full share of these *bugs*.

In buying new and improved implements, we must always have due regard to the intelligence of the laborer who is to use them. An edged tool in the hands of a fool is often a dangerous thing. This consideration again emphasizes the need of a technical education among farmers. An educated brain is a power. A trained hand is valuable. Unite both of these in one man, and you have the possibility of doing wonders. In such cases the brain gives increased utility to the machine, and the machine gives increased capacity to the brain. Machinery does not require feeding or clothing, hence it is generally more economical than hand labor. If kept in order and properly handled, it never makes mistakes.

Another line of farm implements consists of plow, wagon and machine harness. Much of the efficiency of the teams and hands often depends upon the quality and condition of the harness, and many costly mishaps can be traced to worn-out, broken harness. Oil is cheap, and if well used, will greatly increase the length of time harness will wear. A few simple tools, a good piece of tough leather, and a few copper rivets and loose links will save many times their cost.

"Everything in its place and a place for everything," is a maxim of great value when applied to farm tools of all kinds. Order in this department will help in every stage of farm work.

QUESTIONS.

1. What is the most important tool? 2. What is a plow? 3. What power is used? 4. What kind of plow is best? 5. Is any style equally good everywhere? 6. What has demanded attention? 7. What range do plows take? 8. What should we do? 9. What is a harrow? 10. Have we many kinds? 11. What do we need? 12. Do they save labor? 13. What combinations are made? 14. How is planting mostly done? 15. What are manure spreaders? 16. What other machines are named? 17. What is needed? 18. What is said of improved harvesters? 19. How are some of them run? 20. How is corn handled? 21. How is cotton gathered? 22. Is there still room for improvement? 23. How after it leaves the farm? 24. What can the farmer now do? 25. Will the old way do? 26. Would it do for manufacturers? 27. How was grain cleaned? 28 Shall we expect more progress? 29. What prevails among farmers? 30. What should they do? 31. How should tools be cared for? 32. Should paint be used? 33. Why? 34. What requires most labor? 35. What is advisable? 36. What must be considered? 37. What does this emphasize? 38. Why is machine labor cheaper? 39. What else helps? 40. What is a good motto here?

CHAPTER XXIV.

FARM ANIMALS.

This chapter will treat of the animals needed to keep the farm work done. It is not intended to discuss growing animals as an industry or for sale for profit. Every farmer must have and use some animal power in the work of the farm. Human strength is inadequate to do this, for the soil is compact, and force is needed to tear it loose and break it up. Animals are needed for this work. The time may come when steam or electricity may do much of it.

With us the mule is the chief motive power of the farm. He is healthy, easily kept, strong and generally a steady, reliable animal. There is a fitness of things between the mule and the negro. The adjustment seems complete. The negro is always happy riding or driving his mule. The mule can do much more work on the same quantity of food than the horse. He does not require so much attention. He has some ways that are peculiar. The position and movements of his heels are very uncertain, and will always bear watching. If he does not like you on his back, you are not apt to stay there, nor to select your way of going. The chief recommendation for the mule is his power to stand rough usage.

The annual outgo of money from the South for mules is very heavy. Atlanta is said to be the second

largest mule market in the United States. This is not a necessary expense. It is the result of bad habits and erroneous teaching. The mule grows as well anywhere in the South as in Kentucky. When we gave all our

THE MOTIVE POWER OF THE FARM.

time and thought and land to cotton, we did not have the grass to make mule-raising profitable. Cotton is no longer worthy of our whole attention. We can now grow grass as cheaply and abundantly as any section of the country. With our Bermuda grass, we have the best facilities for stock-raising of all kinds. When two years old, the mule is ready to begin work.

With proper arrangements, twenty-five dollars will cover all expenses for these two years. A well grown two-year-old mule sells for anywhere from sixty-five dollars to one hundred and twenty-five dollars. Let us

THE PRIDE OF THE FAMILY.

break off the old habit of buying everything, and raise our own supply of mules.

Horses are preferred for some work. They are more pleasant for road purposes. As nearly every family wishes to enjoy church-going privileges, and the like, many keep horses and mules. What we have said

about raising our own mules is largely true of horses. Horses are not ready for use so early, and are not so tough as mules, hence they cost more—about twice as much. Home-raised horses are better in many respects than those brought from the North. The latter are liable to several diseases and require close and intelligent attention. Yet, with all these drawbacks, we can raise much cheaper than we can buy.

There is one style of horse very much needed and not often found—the all-round farm horse, a horse with fair speed on the road, good pulling qualities in the wagon, and easily kept in fair condition. He should be intelligent, docile, and durable. A plow horse, a wagon horse, a harness horse for family use, and withal fairly good under the saddle, is a rare combination. But he is needed, and the breeder who produces him will make a fortune and bless mankind. Too much attention has been given to the development of speed alone. Speed is a good quality, but not the only one needed. Farmers should have fine blooded brood mares, and then give close attention to the sires. Almost any desired result may be reached by patient study and care. No good farmer should be satisfied with scrubs. The Southern crab grass has no equal as a food for colts. Our climate is all that can be desired. Nothing will so attach your boy to the farm as a fine young horse of his own raising. But power is not all we need on the farm. Food other than vegetables must be provided. The cow comes to our rescue and offers us a wide range of delicacies as well as substantials.

There are no substitutes for good fat beef, raised and killed at home. No shipped Western beef, however well prepared it is, equals the farmer's *fatted calf*.

A few neighbors can provide each a few beeves and form a little club, and so arrange as to enjoy such a luxury in this line as no city man can buy. There are some things money can not buy, and this is one of

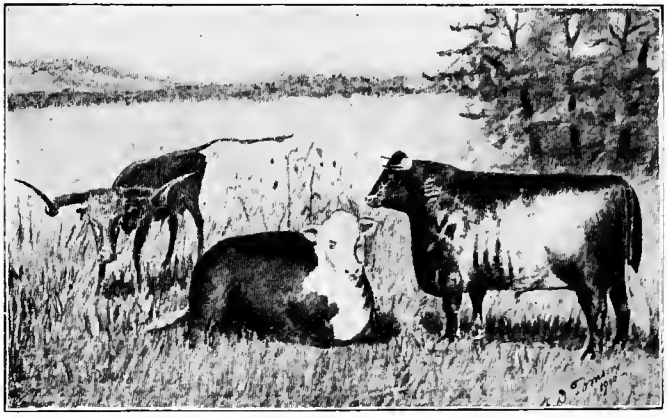
SLOW, BUT SURE.

them. There is no substitute for milk, unless it is more milk. Sweet milk, not skimmed or watered, and buttermilk—fresh from the spring house—are at once the essentials and luxuries of life.

Butter, one of the articles of almost universal use, is another luxury that every farmer can enjoy. Fresh from the churn, spread upon a hot corn hoecake, or upon a well baked sweet potato, or upon a fat barbecued hen, would tempt the appetite of a sick man and make many sick men well.

Cheese, made from the milk, with or without the cream, forms another great article of human food and commerce. So the gentle cow gives us almost all the food needed for health and strength.

The patient ox must not be left out of this list. He pulls anything, whether it be a plow or a stump-puller, or a loaded wagon or a steam engine. Strong, sturdy,

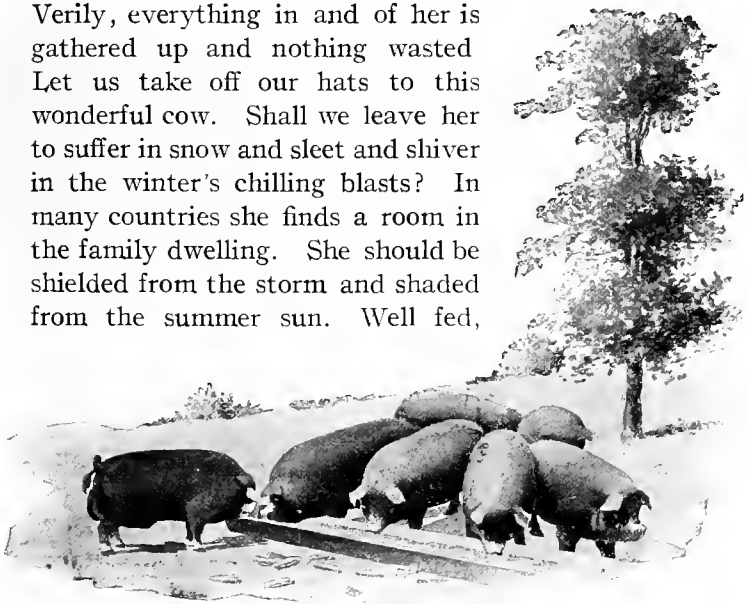


EVOLUTION OF THE KANSAS STEER.

patient, reliable, slow but sure, he is an important annex to the motive power on the farm. The great prophet of Israel, when called to teach mankind through all the ages, was plowing with "twelve yoke of oxen, and he with the twelfth." That plow must have been doing some pretty good work. We have already spoken of the value of the cow as a manure producer. This is no small point in her value. It is almost impossible to make a farm rich without her. We need

many another on our Southern farms. And when at last her race is run, and her earthly work seems well done, her hide enters into new channels of utility, and furnishes us with one of the articles most needed for our comfort and health.

The shoe and leather market could not go on without the cow. Her hoofs and horns and bones are gathered, and after making scores of useful articles of necessity and luxury, the residue and waste are made into the most valuable of all commercial fertilizers. We can not even bid her farewell here, for even the very hairs on her back are numbered for some useful purpose. Verily, everything in and of her is gathered up and nothing wasted Let us take off our hats to this wonderful cow. Shall we leave her to suffer in snow and sleet and shiver in the winter's chilling blasts? In many countries she finds a room in the family dwelling. She should be shielded from the storm and shaded from the summer sun. Well fed,



THE MORTGAGE LIFTER.
(*Courtesy of Correspondence of Agricultural College.*)

and cared for kindly, she yields more for the family comfort than any other animal.

The hog is another useful farm animal, one of the indispensables of our Gentile civilization. He is valued almost entirely for food. By good attention, he will be ready for market at about one year old. The Western farmer finds a good profit in feeding his cheap corn to hogs, rather than selling it. Southern farmers have been largely in the habit of buying hog products. The Southern farm laborer requires hog meat. The Southern farmer should grow his own hogs. During the reconstruction period hog thieves were so numerous that it was unprofitable to keep hogs. But law and order are better observed now, and we should at once return to a business so profitable. Very little care is needed. Provide a pasture with water. Plant groundpeas and cowpeas, chufas, clover, sorghum, and potatoes, and hogs can be fed very cheaply. We can no longer afford to buy our bacon and lard. There are many breeds of hogs. Each breeder claims to have the best. Some have one good quality, others another; experience alone can decide.

The required points for a good farm hog are about these: A disposition to take on fat at an early age, rapid growth, early maturity, and good health. Mixed breeds are often better than any pure breed for ordinary farm purposes. Hogs should be well fed from the start. The first three months are very important. They should be kept free from vermin. Coal oil will do this. The food should be changed to prevent cholera.

Turnips seem to have great value in making them healthy, and preventing cholera. Hogs survive almost any amount of neglect and bad treatment, but they pay well for good keeping and comfortable quarters. The droppings are very rich in plant food, and well worth looking after.

THE CLOTHIER.

Sheep are easily kept, and pay well on Southern farms. There is but one drawback to sheep-growing: dogs are very fond of their blood, and often destroy so many that few farmers care to try to keep sheep. Numerous efforts have been made to get a law passed by our legislators that would abate this nuisance. When this is done, we expect to see sheep on nearly every farm. They increase rapidly, require but little food or shelter, and pay well either in wool-growing or

mutton. Yearling lambs sell readily for double the cost of keeping. A good clip of wool will bring almost as much as the flock is worth. Scarcely any other farm industry will pay so large a per cent. of profit. All that is needed is pasturage for summer, and in winter a cheap shelter, a little cotton seed and salt.

Fowls of different kinds, such as chickens, turkeys, geese and ducks, need scarcely be mentioned as part of the equipment of the farm. Almost every farmer keeps one or more kinds of poultry, and they furnish timely assistance to the housekeeper; for eggs and spring friers are prized very highly by every family. The farmer scarcely misses the food needed to keep up the poultry. They pick up the waste around the house and the cow lots, and devour millions of eggs and young of hurtful insects and worms. One point deserves mention here. There is great difference in the breeds of chickens. A worthless chicken will eat about as much as the best. Some breeds excel in laying qualities, others as mothers, and others as flesh-producers for the table. Some have a combination of these qualities. For the poultry-breeder one breed of chickens might be preferred, while for a common farm another might be better. Without advertising anybody's stock, we feel free to say that for the average farm the Plymouth Rocks, pure or mixed with many of our common farm chickens, are the chickens best suited to our purpose. But, however you may settle this question, there is one point you can not afford to neglect; clean roosts and a bountiful supply of pure water are essential to the health of any breed.

Chickens are larger than mites, but mites are more numerous, unless the roosts are clean. Impure water is generally the cause of cholera.

We have not in this chapter tried to treat exhaustively of any of the farm animals. Either one of these is a good industry itself. Here we have spoken of them as giving variety to the farm productions. Any one or all of the above mentioned may be successfully grown as side helps on any well regulated variety farm. They are helps to each other, and, by decreasing the expense and increasing the income, they make a clear profit where otherwise there would be a clear loss.

They enable the farmer to turn into cash the surplus hay and corn, which would not find a profitable market, and the grass and weeds. More than this, attention to these may occupy what would otherwise be idle hours, and bring in money all along as the family expenses call for it. The Southern farmer has been dependent upon a crop which brings in cash only once a year. Hence he has fallen into the habit of buying on credit, to be paid when this cash comes in. No figures can properly show the evils and losses of this credit system. It has robbed us of our manhood and our self-respect.

At the same time it has taken all the profits out of our business and made us poor. We must break loose from the *tyrant debt* or we can never prosper. Proper diversity in our farming can and will do this. Grow farm animals of as many kinds as you can, and in this way keep at home the money which has heretofore

left us in a steady stream, to pay for mules, horses, and for cow products. Then, when our cotton crop becomes in reality a money crop, we will prosper.

This is the way out of the wilderness. This is the road to success.

QUESTIONS.

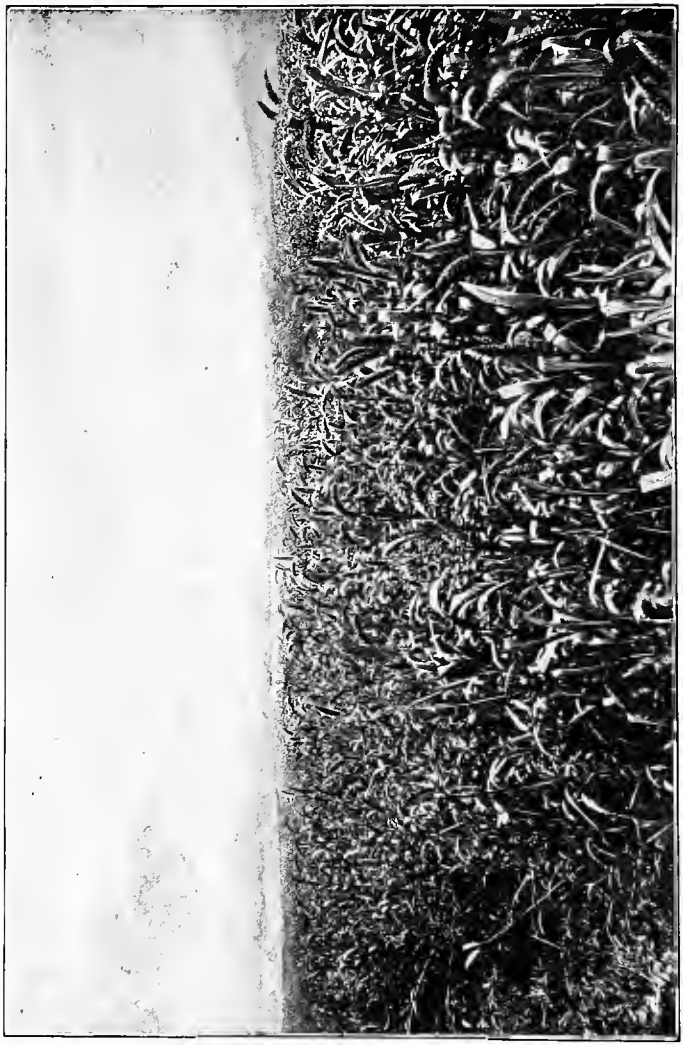
1. What do we study here? 2. What moves the plow? 3. What is the most used? 4. What are his drawbacks? 5. How do we get mules? 6. Is this necessary? 7. What must go before stock-raising? 8. Can mules be raised cheaper? 9. Are horses desirable? 10. Can we furnish our own? 11. What style of horse is needed? 12. Is speed the chief quality? 13. What ought we to do? 14. Have we the grass? 15. What do cows furnish? 16. How may we have good beef? 17. What about milk? 18. What about butter? 19. What about cheese? 20. What is said of oxen? 21. How else does the cow help the farm? 22. What uses are made of her body? 23. What of her hoofs, horns and hair? 24. Should we care for her? 25. What is the value of hogs? 26. Should we buy or grow them? 27. Why did we quit? 28. How should we proceed now? 29. What breeds and qualities do we need? 30. How should they be treated? 31. Does good care pay? 32. Is manure valuable? 33. Can we grow sheep? 34. Why so few? 35. Are they profitable? 36. Can we raise poultry? 37. Will chickens pay? 38. Are they expensive? 39. What about breeds? 40. Which suits the farm? 41. What must be provided? 42. What have we tried to show in this chapter? 43. What do these farm animals do? 44. What more? 45. What has credit done? 46. How can we get rid of it?

CHAPTER XXV.

GRASS CULTURE.

Take away the native forests, and the grass begins to grow. The seed seems to be everywhere. In many places where fire or other causes have destroyed the small trees, we find grass growing abundantly. Among the pines a tough wiregrass grows. If we cultivate a field until by washing and leaching we bring it to a state of exhaustion, and then cease to work it, grass soon covers its nakedness, and clothes it in verdure anew. Many varieties of grass will grow without any cultivation or care. Such is the disposition of the soil to grow grass that it is very difficult to keep it from injuring our crops. We constantly labor and toil to kill the grass in our fields, so that the crops may have a fair chance. From this cause, we have learned to look upon grass as an enemy to the farmer. We spend our main energy upon clean, cultured crops, such as corn and cotton.

It will require some time and effort to bring ourselves to look upon grass as one of our best friends. The idea of growing grass as a crop seems strange to many cotton farmers. To cease to destroy, and tc begin to cultivate grass for money-making, is a revolu tion, but this is just what we should do. We are trying to make money by farming. If there is more money in growing grass than in growing cotton, we had



HAY CROP—THIS BEATS COTTON.

best grow grass. If we take ten acres of average land, prepare it for cotton, buy the usual quantity of fertilizers, cultivate, gather and sell the cotton, we will find that we have spent about eleven dollars per acre, or one hundred and ten dollars. The average yield is one bale of five hundred pounds for three acres. So we will have three and one-third bales, worth, at five cents, eighty-three dollars and thirty-three cents. This leaves us with a clear loss of about twenty-six dollars. If we do better than the average and get a bale to every two acres, we will have five bales, worth one hundred and twenty-five dollars. In this case we have an apparent profit of fifteen dollars, but the extra picking and ginning usually consume this.

If we take the same ten acres and prepare it well, and let grass—common crab grass—grow on it, we will have an expense of about forty dollars. This will yield, at a low estimate, two tons per acre, or twenty tons, worth at least ten dollars per ton, giving us two hundred dollars. Here we have a margin of one hundred and sixty dollars for profit. This may seem too high an estimate on the hay, but we have actual figures, taken from experience, more favorable.

There are other points in this case. The cotton required twelve months' time and attention. This gives us about one crop for a year. The hay will grow in about four months, and leave you six months to devote to something else, and you can get a crop of small grain on the same land in the same year. This is only the native crab grass. There are other grasses that will perhaps do better. Several of them will yield

larger crops. Some of them will cost more to seed. Clover has been known to yield as much as six tons per acre during a season, giving three cuttings. To grow clover the land should be well prepared in September. After harrowing the soil very fine, sow one peck of seed per acre. If thrown upward, it will fall deep enough into very loose soil. Some prefer to sow wheat or fall oats, and sow clover seed on after. The grain should be rather thin. Cut clover when the seed has formed, but before it ripens. If a top-dressing of land plaster is put on after each cutting, the yield will be very largely increased. Some prefer to graze after the first cutting. If not grazed too closely, clover will continue to do well for three years. Properly cured, it is very fine hay. Cut after the dew is off. Rake into windrows next day, and put up in heaps the day after. As to hauling in, much will depend upon the weather.

But the grass which suits the South is Bermuda. Once set, it lives on and on. To get a good stand promptly, plow land well and run furrows two feet apart. Get the Bermuda roots cut up with an ordinary cutting knife, drop every two feet in the furrows and cover lightly. Do this work in April. If you wish it for hay, roll the land smooth. Bermuda grass will root and grow in almost any kind of soil. Manure of almost any kind will pay a profit on Bermuda. Cut as soon as the seed forms appear. Bermuda does not mature seed, but it prepares for that purpose. The hay is easily cured, and not apt to mould, if cut after the dew is off. The yield will depend very much upon the soil

and manure. On good land six tons may be expected. It is slow to get thoroughly set on poor land, and does not like shade. Weeds and other grasses choke it down for a few years, but it is persistent and conquers in the end. It is very tough and resists all kinds of bad treatment, but will show its appreciation of good treatment very quickly.

In pasture, where the soil gets packed, it is well to run a subsoil plow under it once in three or four years, or break it up and roll it down again. Where it is kept for mowing this sort of work pays well.

Experiments seem to show that an acre of land, well treated, will furnish enough feed for one cow each year. So many farmers have been afraid of Bermuda that it has had to fight its way into favor. Hence not many of us know what it will do, except what we have seen it do against all kinds of efforts to get rid of it. Very few have even tried to see what it would do when cultivated and manured. It will grow well in a gully, and at once stops all washing. It will grow on poor land and soon make it rich. It will flourish on rich land and yield enormously. On bottom land it seems to be at its best, as it rejoices in plenty of water.

Frost only seems to take away its green color and part of its water. It is excellent feed after the frost has killed it. Analysis shows it to be equal to the best hays. All kinds of stock are fond of it. Horses have plowed all the summer without other feed—plow all day and turn on the Bermuda pasture at night. Cows make good beef, and give a fine flow of milk and good

FROM FIELD TO BARN.

butter yields on Bermuda grass. Hogs, if kept from rooting by rings in their noses, will keep fat on it. Chickens are very fond of it. It is fine for yards and lots. Some are doubtful about it, fearing they can not get rid of it. It is shallow-growing and can not stand hard freezing, so use a two-horse plow, harrow in December and January, and it is easily destroyed.

It does not seem to interfere much with the growth of other plants, unless it forms a solid mat. So if you keep stirring the land, other crops do well even where the Bermuda is not destroyed. This grass seems to have been sent by Providence to restore the wreck and ruin brought upon Southern farms by bad management. It is certainly a "restorer of the waste places."

Johnson grass grows vigorously and produces large crops of excellent hay. The grass should be cut before seeding. It is then tender and easily digested. If cut at this stage, it will produce another crop in a short time. If the season is rainy, it can be cut four times. This grass spreads from roots and from seed, and hence it spreads very rapidly. The growth is vigorous, and the roots are strong. With small plows it seems to be only cultivated instead of destroyed. For this reason many dread it as a pest, and try to get rid of it. The roots are like cane, with very short joints. The stems shoot up from these joints. If cut in pieces, each joint may form a new center for spreading. If small plows are used, and the grass is permitted to produce seed, the spreading will be very rapid, and the yield of feed very great.

From the nature of this grass, we see two ways of destroying it when it is not wanted. If closely pastured, it can produce no new seed, and the roots, being called upon to furnish food to the new growth at the stem continuously, cease to spread. If this treatment is continued the second year, they become exhausted and begin to perish. Continuous pasturing will destroy it. The roots grow rather deep. In trying to destroy it by cultivation, we must plow below these. Good two-horse turners, rapid harrowing, and clean culture will get rid of it quite rapidly. Turning up, in fall, and winter harrowing hasten this, because the roots are easily frozen. Experience has shown that either of these methods will destroy Johnson grass.

The prejudice against this grass is not well founded. It has grown out of our bad management. The hay has not been properly valued, because we have neglected to cut it before it headed. After heading the stems quickly become woody and make poor hay. Shallow plowing has spread it when it was not wanted. Its strong growth interferes with other plants. So it has become unpopular from the very qualities which should recommend it to our favor. A few acres of land well set in Johnson grass, and well cared for, will yield a crop equal to, if not greater than, any other crop.

Professor Sessions found one hundred and seventy varieties of grass that would grow in the South. He thinks seventy of these would grow profitably. Of course, we can not discuss all of these or any consid-

erable part here. Our object is to show that grass culture may be profitable in the South; that it is not necessary to continue to buy hay; that we can grow all the hay we need in Georgia and other Southern States, and that we can and should grow hay to sell.

PEAS—THE SOIL RENOVATOR.

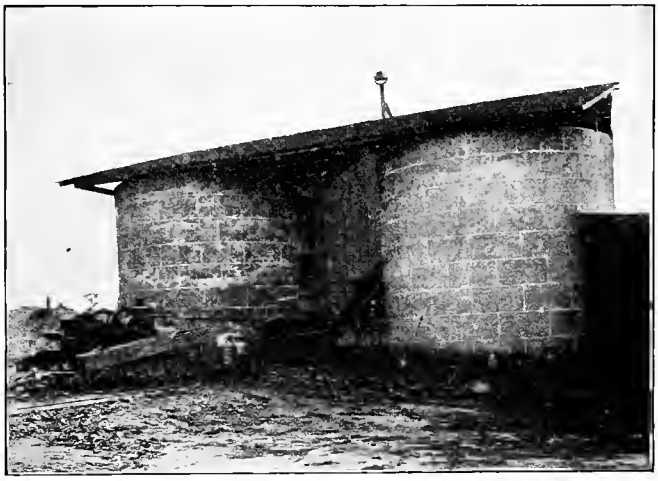
If we grow hay, there will be a market for it, proven by the fact that we are now buying thousands of tons every year. Our soil and climate and water supply make it practicable for us to grow as good hay as we buy, and grow it at less cost than do those we are now buying from. When we grow more hay than we have a market for, we can feed the surplus to cattle and find a profit in that way.

Perhaps we have left out one of the very best hay crops of the South. The cowpea is sometimes called the clover of the South. This plant not only produces very large yields of the very best quality of hay, but enriches the soil that grows the crop. Peas can be planted as an independent crop, or grown with corn, or planted after harvest in the grain fields. In either case they can be made to yield a double crop. The peas can be picked or not. Of course, the hay will be richer feed if the peas are left on the vines. Peas may be planted in hills, drills, or broadcast, as is most convenient.

Curing the vines for hay is somewhat difficult. They contain so much water and nitrogen that they are apt to mould. Cut when dew is off. Next day throw them into small heaps. After two days throw several of these small heaps into one. Two or more days later, according to the weather, they may be housed. If you have grain straw, it will be well to mix in about equal quantities with pea vines. This will insure the keeping of the pea vines, and the straw will be greatly improved for feed. Some prefer to plant poles in the fields with the limbs left on them, and stack the vines upon these until they are thoroughly dry. There are so many methods used that every man can and must decide for himself.

Pea-vine hay is fully as good as any, and is much relished by all farm animals. Where we wish to grow grass for home consumption, we find a still more profitable field for investment. The cattle can save us the expense of cutting, housing and feeding. They

will gladly gather their own feed. While getting it, they will be getting health, and making flesh, milk, butter, and so on, for our profit. Very many of our fields would yield a larger income in pasture than in cultivation. This is true of a large part of the South. But cattle must eat in winter as well as in summer,



THE SILO—A GOOD FACTORY.
(All Material Except Lime from the Farm.)

and we are not supplied with winter-growing grasses in sufficient quantity.

The silo comes to our rescue. Here we can store away vast quantities of green feed ready for winter use. We have been considering the silo as a storage for green corn only. This is a mistake. Many other feed plants may be put into the silo. Pea vines are peculiarly adapted to this use, but if we confine it to

corn, this is itself a grass, and makes the best of grass and dry hay. Fill the silo with green feed, is the idea.

It would not be proper to close this chapter without calling attention to the numerous millets. The German, Hungarian, cat-tail, and the sorghums are among the indispensablés on any well conducted farm. They are all grasses, and very valuable as feed for stock. Chufas, groundpeas, soja, velvet, and other beans are valuable adjuncts.

Let us cease killing ourselves to kill grass, to grow cotton, to sell at less than cost, to buy shipped dead grass with, and begin a new era of prosperity by growing grass to grow cattle. In this way we will clothe the land with living green and fill the land with growing food.

QUESTIONS.

1. Where do we find grass? 2. What happens to worn fields? 3. How do we look upon grass, and why? 4. What will require effort? 5. Should we do this? 6. What will ten acres in cotton cost? 7. What will it pay on the average? 8. If we get half a bale? 9. What will it cost in grass? 10. What will it pay? 11. What about the time? 12. Will other grasses do as well as crab grass? 13. How should clover be sown? 14. When and how often cut? 15. How cured? 16. How do we plant Bermuda? 17. How cultivate and save hay? 18. Does it spread rapidly? 19. What will help the pasture? 20. Why have we been slow to value it? 21. How and where will it grow and yield? 22. Does frost ruin it? 23. How does it rank as hay? 24. How as pasture? 25. How can it be destroyed? 26. How does it affect other crops? 27. What seems to be its mission? 28. What is said of Johnson grass? 29. Why is it dreaded? 30. How can it be destroyed? 31. Should we be prejudiced against it? 32. Can it be made to pay? 33. How many grasses have we? 34. What is our object here? 35. Is there money in hay? 36. How shall we get a market? 37. What can we do with the surplus? 38. What of peas as a hay crop? 39. How can we plant peas? 40. How can we cure vines? 41. Is the hay good? 42. What pays better than hay? 43. How would much of our land pay? 44. How can we provide for winter? 45. What can we put in the silo? 46. What other valuable grasses can we grow? 47. What should we do?

CHAPTER XXVI.

TRUCK-FARMING.

Truck-farming is a name applied to a system of farming devoted almost entirely to growing garden vegetables for sale. It is gardening on a larger scale. It is sometimes called market-gardening. The intense manuring and high culture of the kitchen garden is applied to larger areas. The produce is generally sold in a fresh condition in a near-by town or city. Rapid transportation and refrigerating methods have made it profitable to send these fresh vegetables to quite distant markets. The great cities of the North are thus supplied with the luxuries of the South early in the season. This has given quite a stimulus to truck-farming in the South.

The tendency of salt air to keep off frosts, gives great advantage to the sea-coast regions. A few days' difference in reaching the market often makes a great difference in the price. Every method of hastening maturity is resorted to among truckers. Forcing beds, glass houses, cold frames, heat-producing manures, and early varieties of vegetables all have a bearing upon the success of the gardener. Nearness to market, rapidity of transportation, cost of carriage, and facilities for keeping vegetables from withering and decaying, are other important points. The successful man must study all of these.

Market gardeners find it pays them to use very large quantities of manure and fertilizers. They generally depend largely upon the cities near them for manure. They sometimes find it pays to haul this long distances, if the roads are good. From the larger cities, this manure is shipped out in car or train loads. This is because land near these is not sufficient and gets to be too dear. The cost of carrying manure is less than the cost of the land. Very highly manured land is warmer and hastens the maturity of vegetables.

Another point of great importance to the truck-farmer is the quality of his vegetables. Sorry vegetables are hard to sell, and do not bring paying prices. Good vegetables are always in demand and generally at paying prices. The market is never oversupplied with strictly choice articles. Please the eye and the palate, and you will find ready sale and good profit. To treat of this subject in detail would fill a good-sized book. We can only touch it here generally.

But no one thing is more important to the trucker than deep, thorough work. He must grow large crops on small areas to get a profit on his high-priced land and heavy manuring. More than this, he must grow several successive crops on the same area during the same season. To do this, he must have depth of soil, so as to furnish plenty of root bed and water. He must have fine soil, so that the tender roots may not be hindered in their growth. He must have it both deep and fine, so that he may have a full supply of soluble plant food always ready. The demand will be enormous, and the supply should be equal to every demand.

Work must be very rapid. The soil must not be allowed to bake or crust. The sunshine must find ready access, with plenty of air. This will have much to do with the quality as well as the quantity of the crops. No useless plants or harmful weeds should be permitted to divide food with the growing crop. Selecting a location is quite important, but rests upon different reasons now. Distance is not so important as

A LOAD OF TRUCK.

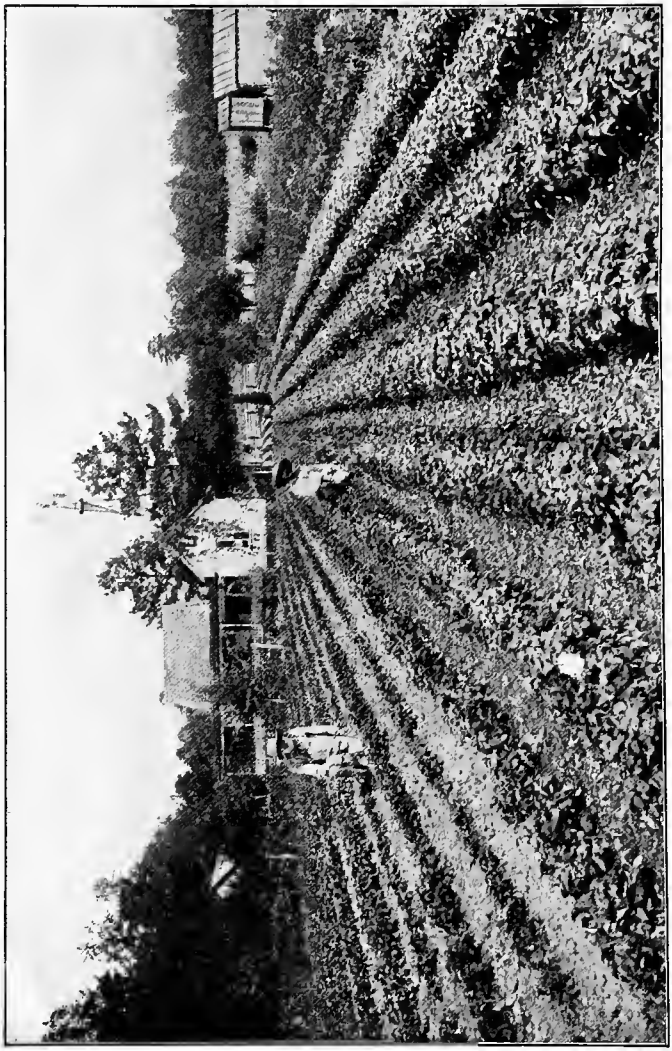
it once was. Access to a railroad is about the only essential point in many cases. Of course, what you expect to sell is always a leading point. Costly and perishable vegetables would require quick access to market. Others, which are cheaper and not so perishable, may be profitable further on.

Onions, Irish potatoes, cabbage, turnips, and such vegetables, can be grown almost anywhere. They will bear shipping and keep well. Lettuce, radishes, peas, beans, and the like, will not take such risks. Two

things should be well considered by every one before going into the trucking business: Do you know how to grow good vegetables? Do you know how to sell vegetables? If you can answer yes to both of these, then you may safely take up truck-farming as a business. If you can not, and still think you would like the business, then you had better work for a year or so with some one who makes a success in this line. There will be time gained by doing this.

As the population increases, this line of work will increase. Besides this, as we of the South learn to better appreciate our advantages, we will do more of this work. Rapid transportation and cold storage are making such wonderful improvements in carrying, handling, and preserving vegetables and fruits that distance makes but little difference. Almost everything depends upon climate and intelligence. Even the most perishable article can be kept several days and delivered in perfect condition thousands of miles away. Skill and industry will give success almost anywhere in the South. The small fruits are generally considered as belonging to the trucker's business. We will speak of a few of these.

Strawberries find a ready sale everywhere. They contribute to health and make one of the most enjoyable dishes on the table of rich and poor. In many parts of the South they can be set out almost any time of the year. June and November are perhaps the best months. The rows three feet apart and the plants one foot apart, gives a good start. If you wish the largest berries, keep them in hills. If you want the



A STRAWBERRY FIELD—A MINE OF WEALTH.

greatest quantity of fruit, let them mat about one foot on the bed, but do not let them get too thick. Provide a new setting every third year. Some plants have only staminate, or male, blooms. Not more than one row in three should be set in these. Some varieties have both staminate and pistillate blooms. If you buy your plants, look to these points. They need only fair manuring. This should be put in before setting plants. If more is desired, put on as top dressing in winter. Keep out weeds and grass and supply plenty of moisture. Some practice mulching with very satisfactory results. They do not need to be covered in the winter and burned off in the spring, as the Northern writers advise. They are shallow-rooted plants, and lack of moisture is their greatest enemy. Plant early and late varieties, ship only the best berries, find a reliable dealer, and you will make money with strawberries.

Raspberries grow well and sell well. A small plot of land will make a large quantity. Many varieties are claiming to be best. The black caps are very good. Plants should be set four feet apart in five-foot rows and kept clean. The shoots grow one year and bear the next. The same canes never bear but one crop. So it is best to cut them out as soon as the young canes get a good start. The buds should be picked out when about three feet high. This will give them body so as to stand strong and branch out well. Proper attention to this point will largely increase the yield.

Blackberries and dewberries require much the same treatment and pay equally well. Because blackberries grow so very abundantly throughout the South, in all

the fields and along the branches, they have not received that attention they deserve. We have not yet found out that culture could greatly improve them. It will be a long time before the market will be supplied with first-class berries.

Currants, gooseberries, figs, and such fruits, belong here. Melons also add to the variety of the trucker's products. Recently the Georgia watermelon has made such a reputation that growing it has almost or quite reached the dignity of a separate industry. Growers plant the vines ten by ten or twelve feet apart. They use fertilizers with a high percentage of potash. The cultivation is simple and easy. They grow very quick. For shipping purposes the thick-rinds are preferred. They are not generally as well flavored as the thin-rind varieties. Many growers prefer to sell in the fields or in car lots, loaded at their nearest station. There is nothing the trucker grows which surpasses in delicacy and flavor the cantaloupe. The genuine article, medium in size, thoroughly netted and tender-fleshed, always finds ready sale. Great care is required to keep seed pure. They mix easily with other muskmelons.

The soil should be well pulverized, not very rich, and lie to the morning sun. Beds should be thrown up lightly, six or eight feet wide. Plant one vine every four feet. Watch for lady bugs, and work rapidly. The worms are apt to destroy all late crops.

Enormous yields are produced by truckers on small areas, and immense fortunes are sometimes realized. There is a small farm near Paris, which is reported as follows:

This farm contains two and a quarter acres.

Rents annually for	$ 500.00
Labor account . .	5,000.00
Interest on the capital	750.00
Account for horse power	500.00
Sundries . . .	250.00
Manures . .	1,500.00
Total amount expended	$ 8,500.00
By proceeds of sales	13,640.00
Annual profits	$5,040.00

We find here two valuable lessons: the enormous productive power of the soil, and the fact that great profits may be made by skill and industry, growing successive crops on the same soil. Here we find men with nerve enough to invest eight thousand five hundred dollars in a two and a quarter acre farm, while many hesitate to risk fifty dollars per acre. They nearly doubled their investment. This is a very extreme case, but extreme cases are instructive. If this has been done, we may do partly as well.

He who grows what every one needs
Will find a market for food and seeds.

QUESTIONS.

1. What is truck-farming? 2. How is the produce sold? 3. What points help to success? 4. What pays in manuring? 5. How is it sometimes carried and why? 6. What other important point? 7. What must be the condition of the soil? 8. Why should the trucker work rapidly? 9 What location is best? 10. What should help to decide? 11 What two things should be considered? 12. What points favor this work in the South? 13. On what does success depend? 14. How should strawberries be grown? 15. Should we be careful about sex? 16. Give further points. 17. Describe raspberry culture. 18. What other berries would pay? 19. What is said of melon culture? 20. Tell of the little Paris farm. 21. The conclusion.

CHAPTER XXVII.

DAIRY-FARMING IN THE SOUTH.

The cow and her products represent a capital larger than all the national banks combined. Cotton, wheat, and corn are each large and important branches of our national industry, but no one of these is equal in volume and importance to the cow and her products. She contributes to the necessities and comforts of mankind in so many ways that everyone is interested in her in some way. In this chapter we will consider the relation of dairying to Southern farming.

For various reasons this branch of farming has heretofore received very little attention. Our people had been educated into the custom and belief that ours was not a dairying section; that we must buy our cheese and fine butter from more favored sections. We were so engrossed in producing cotton that we did not think it worth while to consider whether we could succeed in any other business. We had become so accustomed to spending our energy in killing grass that we did not stop to think whether or not grass was useful. We were taught to believe that our climate was not suited to growing grass, and cows, and making cheese and butter, but we are awakening from our dream and beginning to find out our mistake.

Trial proves that the South is as well suited to grow grass as any section of our great country. On this

discovery rests much of the promise of dairy development. Experience also proves that not only grass but cows flourish as well in the South as in any place. This is true not only of our native cattle, often called "scrubs," but of all the finer breeds. Indeed, it is beginning to look as though the Jerseys and some other

MANUFACTURING BEEF AND BUTTER.

well-bred strains do better here than north of us. This is a great step forward. It is also found to be true that grades from our native "scrubs" make very fine milkers and butter producers. Many claim that the three-fourth and seven-eighth grades are better than the thoroughbred cows. They certainly make excellent dairy cows.

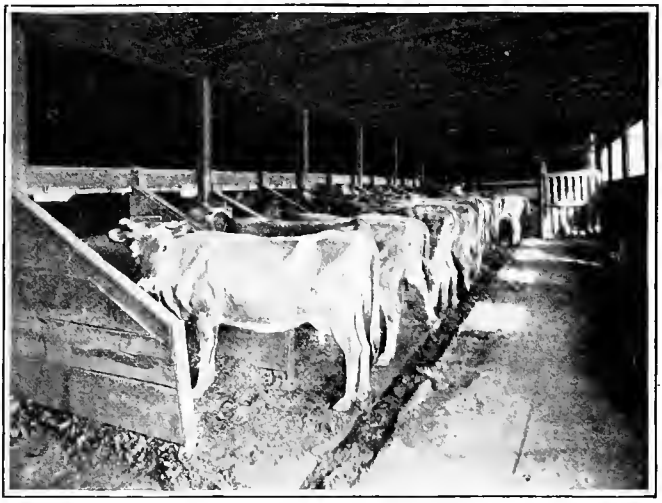
The next question was whether we could make butter and cheese that would bear the test of comparison

with the same articles produced in Ohio, New York and the Northwest. To our surprise, experience shows that we can. This question has been settled in our favor in the great cheese and butter fairs of the North. The South has been the market which has enriched the Northern dairymen. We have bought largely of their cheese and butter, and even of their cream. We annually pay out millions of dollars for these articles of Northern production. It is no longer necessary to do this. We can supply our own products in their place, and keep all this money at home.

Not only is this true, but our soil produces grass so abundantly and cheaply, and our climate is so favorable to the health of the cows, that cheese and butter of the finest quality can be made cheaper here than elsewhere. We can supply our own demand at a fine profit, and compete successfully with other sections in the markets of the world. The very thing which was thought to be against us, is found to be in our favor. Our mild climate enables us to keep cows at less expense, and at the same time improve the quality of the milk. Having better milk and a better climate, we can make better goods at less cost. Hence we have every encouragement to enter vigorously the inviting field of dairy-farming. The soil of the Sunny South, the sunshine and mild winters, the near and ready market, and our unequaled water supply, all invite us into this line of industry.

By dairy-farming we mean keeping cows and selling the milk, butter and cheese as a means of living and making money. To do this successfully requires

a little more intelligence than to grow cotton. The dairyman needs a little special education suited to this particular business. This he can easily get at any of our agricultural and mechanical colleges, or at our experiment stations. To this he can add valuable information by reading a good dairy paper.



INTERIOR OF A DAIRY BARN.

Perhaps the first question will be, where shall I locate? Various considerations enter into the settlement of this point. If you desire to sell milk chiefly, then you should be within reach of some town or city. The railroads are now offering such low rates and other accommodations in carrying milk, that this question is much more easily settled than formerly.

Twenty or forty miles with an early morning train may be just as convenient as two or four miles with a milk wagon. So that nearness to a good railroad is often as good as nearness to a city used to be. The cheapness of land remote from the city may and often will be a controlling consideration. Perhaps a more important consideration should be, plenty of pure, clean water, and adaptability to produce large quantities of grass and grain. Cows well watered and pastured thrive and produce cheap milk. The water should be not only plentiful and pure, but readily accessible to the cows.

Having settled the location, go to work to have plenty of grass growing on your farm. More failures have come from neglect here than from every other point. Most men in the beginning are in a hurry to increase the number of cows. This is pressing at the wrong end. You need first to have plenty of feed growing on your own farm. This you can easily do if you go at it right. Get Bermuda grass well set on good land, both for grazing and mowing. Get a good patch of alfalfa to growing. Plant a good supply of corn for the silo, and then use such supplementary crops as oats, pea vines, rye, barley and crab grass. You will then be ready for the cows. Feed first, mouths afterwards, should be the dairyman's motto.

The next thing is the barn. Here, in the Sunny South, this need not be an expensive building. Comfort, convenience and cleanliness are the points to be aimed at. There is more danger of your cow getting too warm than too cold. Give her plenty of good air,

and room to rest when through eating. Arrange for easy entering and leaving, so as to avoid fighting. Then have a constant eye on convenience in feeding, milking and removing bedding. These must be done so often, that a little loss of time and strength each time, will amount to a serious loss in the long run. But above all things, arrange for cleanliness at every

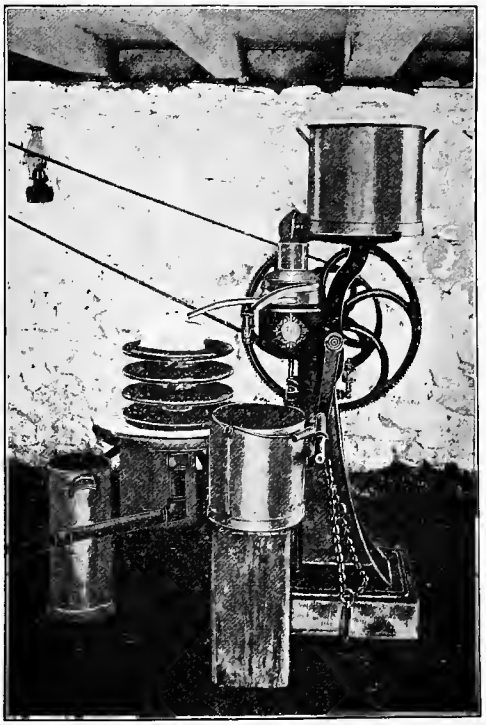
A DAIRY BUILDING.

point. Without this it is impossible to get the best results. Milk readily absorbs smells and microbes. Once infected, it is difficult ever to remedy the evil. The cows must be clean, the stalls must be clean, the vessels must be clean, and the milker must be clean. Filth anywhere is dangerous.

Barns should be so arranged that the voidings can be readily removed and cheaply placed upon the farm, where they are so much needed. The liquid is worth

as much as the solid manure, and should be carefully saved.

Thousands of experiments have been and are still being made, trying to settle the question of the best



A CREAM SEPARATOR—A TRIUMPH OF SCIENCE.

and cheapest method of feeding. These all lead to one general conclusion. What is called a balanced ration is best. This is differently given by different authorities, but in the main means that the hay feed and the

grain feed should be given in proper proportions to get the best results. A grain mixture of wheat bran, corn meal, and cotton-seed meal in the ratio of bran three, corn meal two, cotton-seed meal four parts, makes a nearly perfect compound. For a cow weighing one thousand pounds, seven pounds of this mixture with forty pounds of hay is an abundant supply for one day. Lighter cows need less. Very many dairymen leave out the corn meal. Some use the cotton-seed meal and hulls and get fair results, but it is difficult to find any substitute for wheat bran, or to get best results without it.

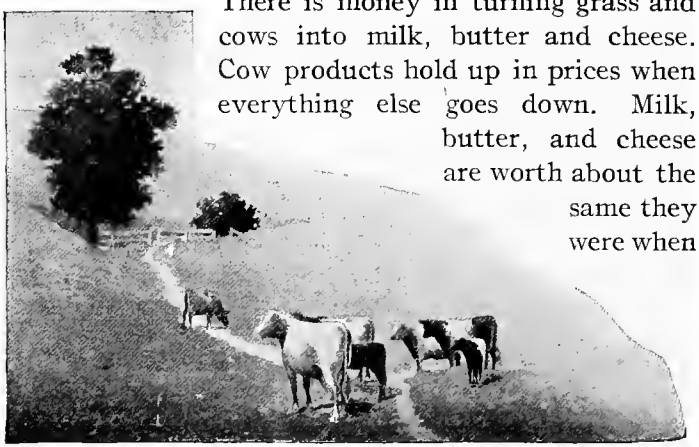
Silage is better than hay, simply because it is more digestible. Whether a silo will pay you is a question to be decided by local surroundings, distance of hauling being an important item. Generally it will pay. Recent improvements have greatly changed the methods of handling dairy products. The Babcock test, the aerator and separator enable the up-to-date dairyman to make money where the old methods failed. As newer and more economical machinery is being constantly invented, all that a book can safely say is that the man who keeps up with the times will make money almost anywhere.

If you handle your milk with absolute cleanliness and make butter or cheese of first quality, you will always find a market at good prices.

The possibilities of dairying are greatly improved by the building of creameries. These enable many to find a profit in keeping cows without making dairying their sole business. Through these, conducted

on the co-operative plan, many farmers will find it to their interest to grow grass and raise cows instead of cotton alone. Statistics of the United States show that we can grow grass cheaper in the South than in the North. Hence we can keep cows cheaper, and produce milk and butter and cheese cheaper. Dairying in the South has a bright prospect before it.

Our young men will find it more certain, pleasant and profitable than thousands of city occupations. "Young man, go to the dairy farm" should be substituted for "Young man, go west." You need not go west. Right here you can find home comfort, happiness, and prosperity, if you will rub up your brains a little, get a few cows, and settle down on a dairy farm, and invite some sensible Southern girl to preside over your household affairs and help you run a dairy. There is money in grass. There is money in cows. There is money in turning grass into cows. There is money in turning grass and cows into milk, butter and cheese. Cow products hold up in prices when everything else goes down. Milk, butter, and cheese are worth about the same they were when



cotton was twenty cents a pound. If the article is good, the market is ready for it.

What breed is best? If you wish milk, the Holstein is the cow. If you wish butter and cream, the Jersey. If you wish all of these, then high-grade Jerseys and Holsteins will serve your purpose.

QUESTIONS.

1. What is the value of the cow and her products? 2. How has dairy-farming been looked upon? 3. Why? 4. What have we been taught? 5. What do we now find true? 6 What else? 7. Can we make high-grade butter and cheese? 8. Shall we continue to buy these? 9. What else may we do? 10. What of our climate? 11. What are we invited to do? 12. What is dairy-farming? 13. What do we need to succeed? 14. What is said about location? 15. What is more important than distance? 16. What is first to be done? 17. How? 18. What should be the dairyman's motto? 19. What should guide in building the barn? 20. Which is the most important of the three? 21. What should be done with manure? 22. What next claims attention? 23. What makes a good ration? 24. How much a day of this? 25. What about silo and silage? 26. What about handling milk? 27. When is our market sure? 28. What about creameries? 29. What do United States statistics show? 30. Where should our young men go? 31. What should they do? 32. There is money in what? 33. Do cow products fall in price? 34. What cows are best?

CHAPTER XXVIII.

STOCK-GROWING.

We have spoken of different kinds of animals grown on the farm for farm uses. We wish here to speak of growing one, or several of them, as a special business. Stock farms may, and often do, grow grain and grass as feed for the stock, but the money is expected to come in from the sale of the animals. Stock farms may be devoted to growing only one line. Thus one farm grows horses, another mules, another cows, another sheep, and another hogs. Not only so, but a farm may be confined to one or more breeds of a single line. Thus we have farms which breed and develop only race horses, another only draught horses. One farm will make a specialty of Jersey cows, another of Shorthorns, another of Holstein-Friesians, and so on. Some devote themselves to red Jersey hogs, some to Berkshire, some to Chester White, some to Poland-China, and some to Essex.

Instead of being a small field of enterprise, this is a very large field. It is also very attractive to those so inclined. Large profits have been made in all of them, but these lines of farming require something of intelligence and business capacity. To insure success, you must study your line thoroughly. The finest breeds of horses have been grown in Kentucky and Tennessee. There is no reason in the natural advan-

tages why the same may not be done in the remaining Southern States.

As we have already shown, grass is the cheapest feed for stock of all kinds. We have given too much attention to killing grass and raising cotton. But with our Bermuda, crowfoot, and crab grass and others, this need no longer be true. Here we do not need

A HANDSOME PAIR.

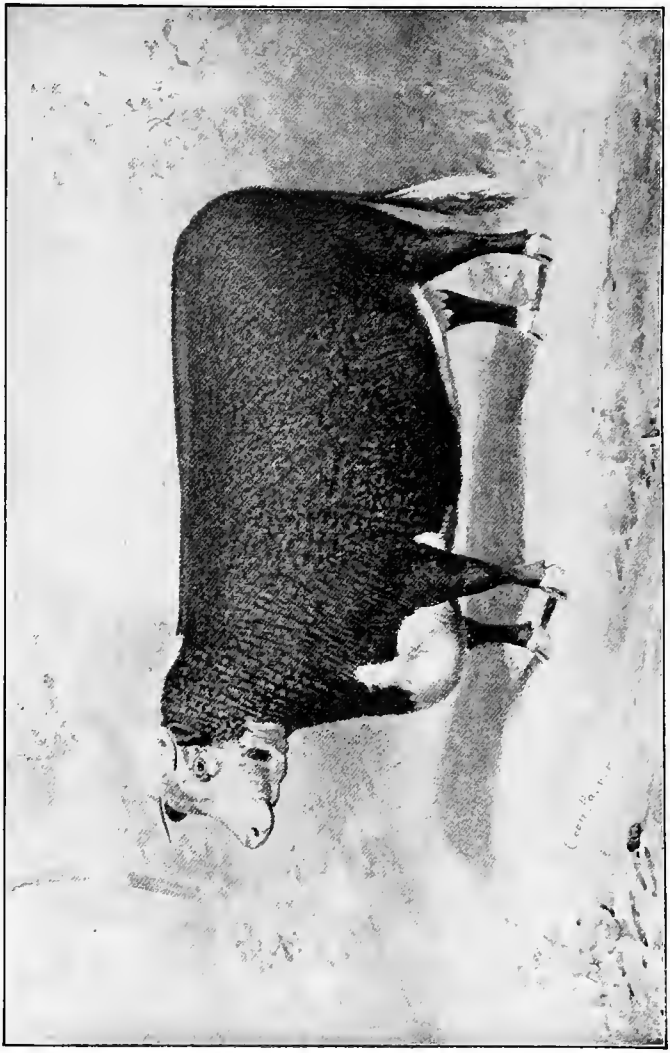
expensive barns. Our colts can run out all the summer and most of the winter. This gives them good constitutions. They are liable to but few diseases. They grow to fine size. Georgia-raised horses seem to have more power of endurance than those grown north of us. Our feed can be grown here, and as cheaply as anywhere.

A THOROUGHBRED BULL.

Blooded horses, as they are called, bring the best prices, but it is not settled that they are the best paying horses to breed. This book can not enter into the details. If you wish to succeed you must make your line a special study. To do this, you need books on these particular subjects, and, fortunately, they are to be found in plenty. Our aim is to point out the various lines of farming, and give elementary principles only, particularly to do this in such a way as to show that this Southern country is as well adapted to these higher lines of farming as other parts of our great country. The presence of so large a colored population and the consequent almost exclusive cultivation of cotton has caused many wrong ideas of our capacity to spread abroad and even grow up with us.

Stock-raising can be successfully followed here. We can breed as good horses, and make as much money at it as any section. Mules are easily grown here. Farms devoted entirely to this line would pay well. They mature early and require very little hand feeding or care of any sort. Growing cattle for the market, whether as milkers, breeders, beeves, or oxen, is an industry always inviting. You may select one or all of these lines.

Raising grades from fine thoroughbred stock is the least risky and the most profitable, unless you wish to sell high-bred cattle at fancy figures. Cattle serve so many purposes in human economy that they will always be in demand. A little capital, a large share of industry, and good judgment will soon bring in the



A THOROUGHBRED COW

money The great cattle ranches of the West will not last always. The pressing demands of a growing and crowding civilization will cut them into farms for other purposes, but the demand for cattle will continue, steadily increasing with the onward movement of civilization.

The future will see great packing houses in Atlanta and other Southern cities, competing with Kansas City and Chicago. Creameries, cheese factories, and packing houses will give aid to cattle-growing. The wise farmer will study cattle instead of cotton.

Hogs were on every farm in the South before the war between the States. The high prices paid for cotton many years after this war ended, the fearful depredations of hog thieves and the introduction of commercial fertilizers, have conspired to destroy this branch of farming. Better enforcement of the law, the low price of cotton and the large profit in hog products, all point to the revival of this industry. The manufacture of ice and the improvements in cold storage make it quite possible to grow hogs profitably for market. Packing houses may be run successfully anywhere in the South.

Almost any one can grow hogs. The chief requisite is plenty of corn; then a good pasture, well-watered, will complete the outfit. With Bermuda, cowpeas, chufas, Spanish groundpeas, sweet potatoes, and turnips, and with sorghum added, you can have cheap feed all the year round. The best breed must be determined by each grower. The Poland-China grows rapidly and very large. The Berkshire and Essex

breeds, pure or mixed, fatten well at an early age. Either of these, with some Poland-China blood, makes a very profitable market hog. With small capital, industry will be almost certain to insure success. Some farmers in the extreme southern part of Georgia are making money growing hogs to ship North. If young men will study this line of farming instead of cotton-growing, they will find farming more pleasant and profitable.

In stock-growing lies the future prosperity of the Southern farmer. There is less competition and better pay than in cotton-growing. If cotton has been and must remain king, let grass be queen, and "the cattle upon a thousand hills" the fair offspring.

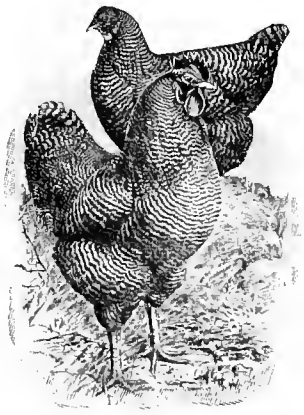
QUESTIONS.

1. How will we discuss stock-raising? 2. What may be selected? 3. Is this a large field? 4. What is needed for success? 5. Can we grow fine horses? 6. What circumstances are in our favor? 7. What horses will pay best? 8. How can we succeed? 9. What has hindered? 10. What about growing mules? 11. What about cattle? 12. What will insure success? 13. What will become of Western ranches? 14. Can we have packing houses? 15. What about hog-farming? 16. Have we the feed for cheap hogs? 17. What can take the place of cotton?

CHAPTER XXIX.

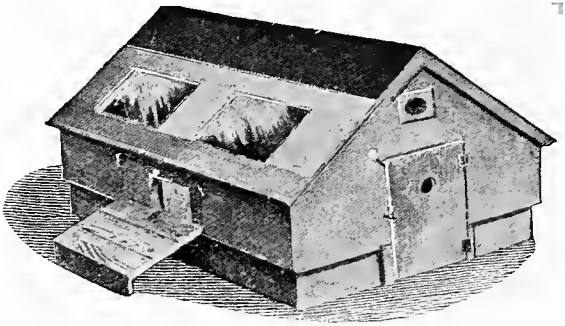
POULTRY-FARMING.

This may seem to many a rather fanciful idea, but it is not at all so. Growing poultry, either as a side line on every farm or as an independent business, is altogether practicable, and may be quite profitable. The poultry farm may be run either for the purpose of selling pure breeds at fancy figures or eggs by the sitting, or both, or growing poultry for the market, or all of these combined. The management will depend a good deal upon the end in view. Very little room is required for a poultry yard. The back yard of a city lot is often sufficient. If the object is to grow fancy birds, then a small area will answer. The one essential point in such cases is to keep the breed pure and grow perfect specimens of the kind selected.



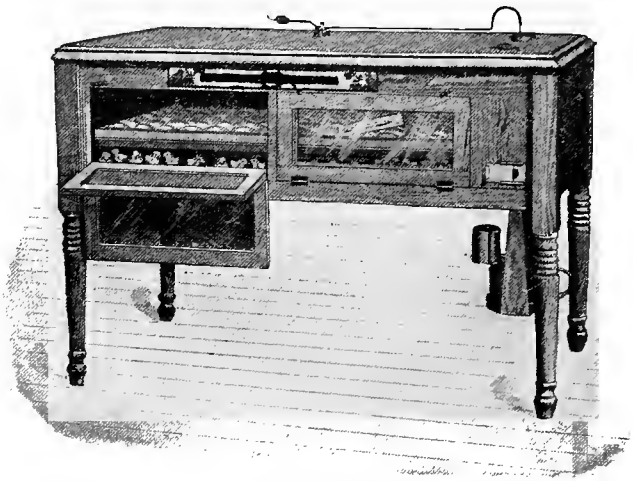
While the term "poultry" includes ducks, geese, peafowl, turkeys, and the like, we shall speak here chiefly of chickens. In our Southern climate we do not need tight, warm houses, but open and airy ones. There should always be several yards or walks fenced in separately. Chicks of different ages can then be kept entirely separate,

so that, if there be different breeds, they may be kept apart. All yards and roosts should be kept clean.



BROODER.

Sand for the stomach and dust for the birds are very necessary. The one helps digestion, the other is the surest remedy for vermin. If the roosts or nests



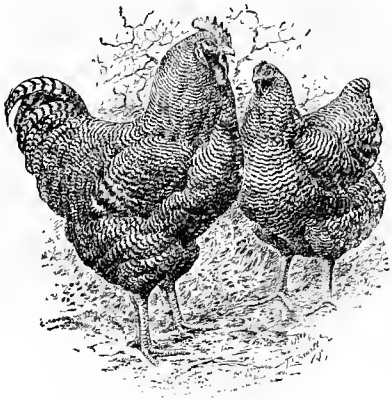
INCUBATOR

become infested, a free use of whitewash and coal oil is the surest way to get rid of them.

A little sulphur, mixed in the food occasionally, is wholesome. Lime, kept where the hens can have free use of it, helps greatly in producing fine eggs. Pure water should always be at hand. Copperas, in the drinking water once a week, will prevent many diseases. Chickens need a moderate amount of exercise and sunshine. The feed should be changed as often as convenient. Chickens are fond of green feed, and a small plat of Bermuda will prove helpful. Cabbage, turnips, clover, oats and other small grain while growing, all or either will be found valuable.

These cause the hens to lay more, and the young chicks to grow faster. There will always be a ready market for eggs, frying chickens, young hens and cockerels. There is no trouble about the market. The trouble is always on the side of the supply. Sometimes eggs are too abundant in August. By washing them in lime water, or packing them in salt, small end downward, they may be kept fresh. The one essential thing is constant attention to the minor details. By intelligent breeding the quality of your chicks may be greatly improved or continually kept up.

Many people do not know that there is as much difference in the food value of eggs as in almost any article of food. Well kept, healthy hens lay larger eggs, with much richer yolks, than poorly fed and neglected hens. This point will be better understood in the near future. A fat, plump chicken is worth to the housekeeper more than two lean, half-starved

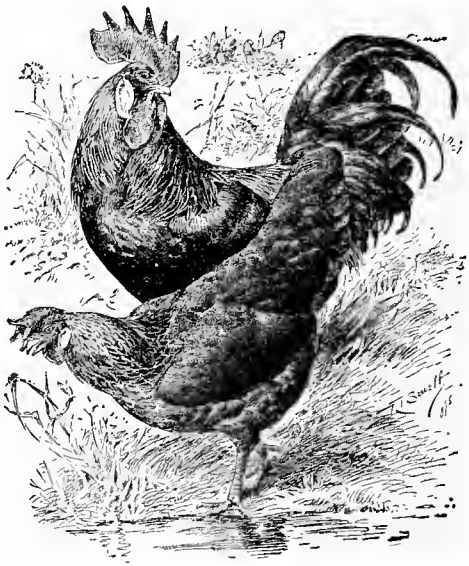


BARRED PLYMOUTH ROCKS.

chickens of the same age and apparent size, as illustrated by the prevailing tendency toward pricing fowl by weight rather than by appearance, which is certainly a step in the right direction. This is a line of farming eminently suited to the tastes and capacities of women. It gives them outdoor exercise, without unnecessary exposure.

The use of incubators and brooders has wrought quite a revolution in the poultry business.

We shall not discuss them, because improvements on them follow each other so fast that what we might say now would be out of date in a few years. This much may be said, however, that by the saving of space, as also of time which



BROWN LEGHORNS.

would o herwise be spent by the hens in sitting and rearing, these contrivances certainly effect great economy. Whether the expense and risk incurred offset these, each must decide. One thing we wish to emphasize: no section can claim a monopoly in chickens and eggs. The poultry business is cosmopolitan. It knows no North, no South, no East, no West. It is as boundless as the globe and as prevalent as the human race. Steadily, as civilization treads on its onward march with even step, the chanticleer's shrill voice is heard.

The South, however, does possess climatic advantages which make poultry-farming very attractive.

QUESTIONS.

1. Is there profit in poultry? 2. How may it be made profitable? 3. Is much room needed? 4. What is needed in our climate? 5 What will keep them healthy? 6. What about exercise and food? 7 Is there danger of oversupply? 8. How may breeds be improved? 9. How may products be improved? 10. What of incubators and brooders? 11. Is this industry local?

CHAPTER XXX.

BEE-KEEPING.

The author not being an expert bee-keeper, this chapter was written at his request by Miss Anna Sanders, of Whitaker, Miss., who is an acknowledged authority on this subject. Many of our ladies seeking employment may find pleasure and profit in bee-keeping. Miss Sanders says:

Bees must be interesting to every thinking person who sees enough of them to appreciate their wonderful intelligence and industry. Man has enjoyed honey from the earliest times. It is often mentioned in the Bible. Canaan is described as a land where milk and honey flowed, showing that it was abundant, and that it was regarded as something much to be desired. It is not only palatable and healthful, but medicinal. I wish it might be on every table in the land the year round. Consumption, coughs and colds would not then be so prevalent. True, there are a few who dare not eat it.

Bee-keeping is intensely interesting, when you get familiar with it. There should be a few stands of bees on every farm. With judicious attention, they pay wonderfully well. Any one can make a success of bee-keeping now, with the movable-frame hive, the extractor, the Italian bees, the comb foundation bee veils, gloves and other helps.

If you wish to try it, you should get your bees early in the spring. The danger of frost is then over, or nearly over, the hive is lighter and can be more easily and safely moved, and the bees will have the whole season to work for you. You should learn their condition at once, and keep posted all the time till you are sure the honey season is over. My earliest extracting was the 15th of April, my latest the 4th of July, but it was too late. The bees did not have time to replace their stores before the hot dry summer. I was away, and half of them starved. I have seldom extracted in the fall. They need all the fall honey to carry them through the winter. If they are weak, they may not lay up enough in the fall.

My earliest extracting commenced on the 15th of April and lasted three weeks. It was poplar honey, very fine, and averaged forty gallons per hive. I might have commenced earlier, if I had been watching more closely. The hive was full when I learned that the poplar was in bloom, and commenced. This supply stopped suddenly, but there was a later yield of some other kind, a few gallons per hive. Then the latter part of summer they were bare of stores, and would have all starved, if I had not fed them the latter part of September and the early part of October. I fed at the doors of their hives a little every evening until the 8th of October, when they commenced gathering honey. The flow lasted eight days, and was plenty for the winter. I did not feed over one half pound of sugar per hive. I do not often extract under four days after a previous extracting, and never under

three days, except that one season. Being unmixed poplar honey, it was almost thick when I gathered it. When it is ripe the bees commence to cap it. Thus can you tell when to extract. The seasons are very variable as to the flow of honey, the source and the time, but if you have strong stocks in good hives, and give them proper attention, they will do all for you that you should expect. If you want to get all the honey you can, and prevent swarming, you will have to watch closely that your bees are strong. One year I had one hive four stories high, ten pounds in each story, eighteen by nine inches. I got six gallons of honey at one extracting from it. It was full of bees, brood, and honey. "Bees work for nothing, and feed themselves," but it is greatly to your interest to keep them strong. If they are not strong early in the season, they will be rearing brood when they should be gathering honey. Before opening a hive of bees, you should smoke them until they roar, wait a little, blow in another whiff, and open. Burning lint cotton in a horn answers very well. Keep your smokers ready, and also fire close by, while you have the hives open. It is best to work with them when they are busiest, then there is less danger of their stinging. Do not stand in their way, but at one side. Avoid jarring the frames. Their rules of etiquette can not be safely infringed. Certain odors are offensive to them, the human breath especially if tainted with tobacco, whisky, or onions, as well as certain perfumes.

Have everything ready so that you will not disturb them unnecessarily long. Do not use feathers

when you wish to brush them off any place, but use a small whisk broom. Loosen the ends of the frames with a pocket knife. Loosen all that you are going to lift, before lifting any. If you will put them often into a clean hive, burning all the trash that was in the other, it will greatly lessen the moth trouble. I keep them covered with cloths while the hives are open. They should be so placed that they will be shaded in the heat of the day, although they need some sunshine. Northern bee-keepers like their hives low so that the bees, when chilled and fallen to the ground, can crawl in. We, in the South, have to guard more against heat and pests, moths and roaches especially, than against the cold. Our hives should be large enough to allow light and air under them, and also chickens to pick off worms and bugs.

There is only one queen to each hive, and should she die and they have no brood or eggs to replace her, they become very miserable and soon die out. She lays all the eggs. She has a larger and longer body, and is in fact entirely different in appearance from the workers. Each egg is attached to the bottom of the cell by a glutinous substance, which keeps it firmly in place. In three or four days it becomes a little worm, and is fed by the bees on pollen and honey (bee bread). When sufficiently large, the bees seal up the cell, and the little creature spins a delicate lining to the cell exactly fitting it. The little thing gradually takes on legs, wings and all the organs necessary for a full-fledged bee, which it becomes about the twenty-first day if a worker, or the sixteenth if a

queen, the drone requiring about twenty-four. It then cuts its way out ready for work.

The age of the bee usually determines the work it does; nursing, pollen-gathering and honey-gathering; coming in order; the last work of the worn-out bees being to add to the heat of the hive by fanning the hive proper with their bodies. I think any of them can do any kind of work, and do it when circumstances require. A hive with glass sides, just a single pane to observe, having wooden slides outside to keep them dark when not being observed, affords an opportunity for watching all the proceedings of these most wonderful little people. This is especially interesting when you introduce an Italian Queen into a hive of black bees.

A colony of bees in a normal condition consists, besides the queen, entirely of workers and imperfectly developed females, except in the swarming time, when there will be a few thousand drones. Their only use seems to be the impregnation of the queen, which takes place high up in the air and usually only once in her life. When the swarming season is over, the drones still remaining are persecuted and driven away. When the flow of honey stops suddenly and entirely, they are killed off at one swoop. I have been keeping bees over thirty years, and have had this happen only twice. In the evening all seemed serene, in the morning at each door was a pile of dead drones, nearly a quart at some of the doors. The reason, evidently, for their keeping their drones so long in the South is that our climate and forage are such

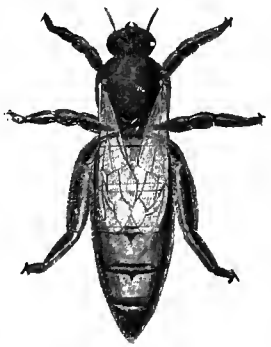
that they think swarming is in order a long time, and keep ready for it. The wholesale killing is the usual way in the North.

A queen can be raised from any worker egg. From the time an egg or worm is chosen to become a queen, it is treated with great consideration. A queen cell is entirely different from all other cells. Compared with them, it is immense in size. It is often more than an inch long, and has very much the appearance and shape of a pindar. It is built on or out of a worker cell usually, and quite a number of worker cells or sun-brood cells are sacrificed to make room for it. It is built most frequently at the bottom or sides of the comb, or where there is a hole in it, and hangs so that the embryo queen has her head downward, after a certain stage in her development. The little embryo queen is kept swimming in food—royal jelly, they call it, although it is now, I think, generally understood to be the same food as is given to the workers, and that the perfect development of the queen comes from the abundant supply of food and room, and perhaps the hanging of the cell has something to do with it.

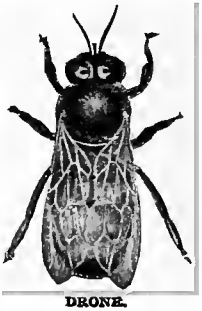
The beautiful hexagonal cells of the honeycomb will always excite admiration. There are sixteen drone cells and twenty-five worker cells to the square inch. Wax is secreted by the workers, and comes from between the rings around their bodies in little pearly scales, which they chew up in their mouths to prepare it for building the cells. A certain temperature in the hive is necessary for the work, as well as for brood-raising. The length of a bee's life depends upon circumstances.

WORKER.

In the North, where they are shut up all winter in close quarters, they live many months. In the South, in the honey season, they live a very short time, not more than three or four weeks sometimes. They wear themselves out flying. We have learned a great deal by introducing Italian queens in black hives. Queens live several years, but I have never had one I valued much after the first year. They will exhaust themselves sooner if they are laying eggs a considerable part of the year. The time of mating and the time of commencing to lay eggs after mating, as well as the number of eggs laid, depend on the weather, the condition of the bees, the flow of honey, and on the vigor of the queen. In that wonderful year I had a queen that commenced laying before she had been two days out of her cell. Usually it is several days before she takes her flight, and several days more before she commences to lay. It is said to take from thirteen to twenty-seven pounds of honey to make one pound of wax. Thus you see the value of the extractor, as you extract the honey completely, and return the combs to the bees an unlimited number of times.



QUEEN.



DRONE.

If you wish to catch swarms, it is well to have a hive ready, with some comb foundation in a frame or two to start the bees. Have a lighter box or basket to bring the swarm in, if at a distance. Pour them at the entrance of the hive, and with a shingle or something pour part of them right into the doorway, thumping on the hive with a stick in the meantime. If you can put a card of real brood (unsealed) into the hive, you will almost certainly get them. Keep coaxing them in, until you hear the hum of acceptance.

Wonderful strides have been made of late years in this industry, which we bee-keepers think so fascinating, but much still remains to reward the careful research of those who love to look into the curious ways of this most interesting of all of God's little creatures.

For those who love honey and money made from honey, there is a wide field for the industrious, the energetic and the inventive. For instance, please find a comb foundation that will please the bees, and not please the moth. In this short chapter I tried to inspire some of our own love in the hearts of others for our little pets.

QUESTIONS.

1. Who is the author of this chapter? 2. How long have we had honey? 3. Is it desirable? Why? 4. Is bee-keeping interesting and profitable? 5. Then should we begin? Why? 6 When can we begin extracting and how long continue? 7. How much has been extracted in a season? 8. Is it ever necessary to feed bees? 9. How can we tell when to extract? 10. How much from one extraction? 11. Why should bees be kept strong? 12. How shall we proceed to take the honey? 13. When is the best time? 14. What is offensive to bees? 15. How can we help to keep out moths? 16. How shall we proceed? 17 How

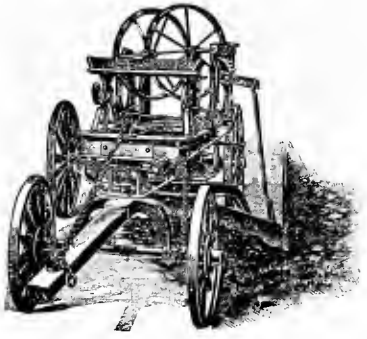
shall we place hives? Why? 18. Tell about the queen. 19. Describe hatching and growth of workers. 20. What decides the bees' work? 21. How may we observe their work? 22. What adds to the interest? 23. What makes up a colony? 24. What becomes of the drones? 25. Why do Southern bees keep drones longer? 26. How can a queen be raised? 27. Describe the process fully. 28. Tell what you can about the cells. 29. How long do bees live? 30. How have we learned a great deal? 31. What is the life and history of the queens? 32. How much honey makes a pound of wax? 33. How shall we save the swarms? 34. Has much progress been made? 35. Is all known? 36. What was the object in writing this chapter?

CHAPTER XXXI.

FARM AND PUBLIC ROADS.

Good roads are a matter of interest to all. The city man needs good roads for pleasure and for business. The merchant feels much interest in the roads, because they affect his business. The bicycle riders, above all others, desire and demand good roads. To them we are largely indebted for much that has been done and that will be done to secure better roads. Railroads are much interested in this subject. If the wagon roads that lead to their depots are good, it helps their business. But above all others, the farmers are dependent upon the condition of the roads. They must do a good deal of traveling and hauling. To them bad roads mean loss every trip they make. The time required to make a given trip is much increased if the roads be bad. In a lifetime this becomes a serious item. Again, the wear and tear on teams, vehicles and persons is more than doubled by the ordinary country road. The load that can be carried is determined by the worst place in the road. This generally means that a comparatively small load only can be taken. An ordinary double team will carry from three to four times as much over a good, macadamized road as over the ordinary country dirt road. Thus we could save about two-thirds of the trips in marketing our crops and hauling our supplies. Two mules, if the roads be

bad, take two bales of cotton to market; on a good road they can carry from six to eight bales. The comparative saving can not be estimated. With good roads, the distance to market would be less objectionable to the farmer. The facility for getting the mails, going to church and school, visiting and to social intercourse, would be so changed as to make farm life entirely different. Very many objections to living on the farm would at once disappear. Farmers could then keep in touch with the world and in sympathy with the age in which they live. The farm carrying could then be done when the weather was not suited to farm work. With the ordinary dirt road, this is the time when it is in the poorest condition for use. Good roads increase the value of farm property, cheapen the cost of the necessary marketing, increase the value of farm products, make farm life happier, and uplift the entire interests of the community.



A MODERN ROAD MACHINE.

What are good roads, and how shall we get them? Every one knows what bad roads are. Most of us have learned that water is the chief cause of bad roads. Sometimes the trouble is injudicious location of the road. If a roadway runs right up a steep hill, it will always be a bad road. Roads should always go around steep grades. Over six feet rise in one

hundred should be avoided. Four feet is better, and can generally be obtained. A team can pull about twice the load, if the grade can be kept two feet in one hundred. Skilled engineering will pay.

The next point to be secured is a firm road bed, neither mud nor sand. This should be kept free from

AS IT IS.

cuts and holes, caused by standing or running water. Water must be kept off the road bed. Water drains must be so constructed as to keep the road bed dry. The center of the road bed should be higher than the sides, so that the rain water will run off the road, instead of along the road. The bed must be so firm that it will not yield to the wheels. Broad tires would help very much at this point. Now, how to get this

hard road is the most important and difficult point. Conditions vary so much, that some can succeed one way and others another way.

Macadam is the best, if you have the money, and the material near at hand. The cost will vary from $1,200 to $7,000 per mile. The roadway must be surveyed and graded, and seven or eight inches of broken stone placed upon it, and two inches of fine

AS IT SHOULD BE.

stone upon that. This will make a first-class, permanent road. Where this is too expensive, and chert can be had, it will make a good road; but for country-road building a mixture of sand and clay will very often be the most suitable. Properly mixed, they make a very good road. If the work is well done, and repairs promptly made for a few years until they become well settled, they will be found durable. In a long series of years, they will be cheaper than the ordinary dirt roads and infinitely better.

All improved roads necessitate a road tax, instead of day labor by the citizen. A competent engineer must be had, and the work done under a superintendent who knows how to manage labor and build a good road. Convict labor should be employed on public highways. It is the only place where their labor will be for the benefit of all, and come in competition with none.

The State should bear one-half the expense, the cities and towns one-fourth, and the country people one-fourth. In ten years a system of roads could thus be built, and with very little, if any, increase of taxes. Good roads would greatly lessen crime, and elevate citizenship. What light does to break up crime centers in cities, good roads will do in the country. The State could pay a good part of its half with labor and material. But whether this system or some other be used, by all means let us have good roads. They will make free mail delivery practicable everywhere. But farmers need farm roads, and it is very important to have these located well. A farm will remain while the world stands. If your roads are well surveyed, so as to have no hard pulls, and divide the farm in such a way that every part can be easily reached, they will likely remain for all time. If badly located, these roads are likely to start washes. Once properly located, they should be made permanent. They will thus contribute to the happiness of the family, as well as to the income of the farm. Good roads will greatly help to stop the flow of country people to the towns. In our boyhood days we lived eight miles from the country

town. It was a good day's work to go up to town, transact a little business, and get home after dark. With a good road we could have made the trip before breakfast or after supper, and saved the day for work on the farm. In Italy it used to be said, "All roads lead to Rome." In this day, in America, it should be said, all roads lead to the farm.

QUESTIONS.

1. Why do good roads interest the farmer? 2. What do bad roads cause? 3. What would good roads save us? 4. What other advantages? 5. What about time of hauling? 6. What effect upon the value of the farm, etc.? 7. What about location? 8. What is the next point? 9. What ruins roads? 10. How can this be avoided? 11. How can we get hard roadbeds? 12. What is the best, and the cost? 13. What can be done almost anywhere? 14. Will tax cost more than labor plan? 15. Where should convict labor be used? 16. How should the expense of building good roads be divided? 17. What will they make practicable? 18. How about farm roads? 19. How will they help? 20. What illustration is given?

CHAPTER XXXII.

FARM BUILDINGS.

Home should be the sweetest place on earth. Nowhere else can nature and art so well combine to produce perfect results. In the field we toil. In the home we rest. Here all that is purest and best collect. This is the center. Around this all the other things we value arrange themselves. This is our earthly paradise.

Let us move carefully and cautiously as we build the farm home. Select the location for beauty, comfort, and convenience. This order has generally been reversed, if considered at all. Beauty was left to the last and least; but beauty must have first rank in so many things on the farm that we insist that beauty should have first consideration in locating the lifetime home of the family. A mistake at this point can never be remedied. A pretty location is a joy forever. It is a wellspring of happiness through all time to every one. It is the one thing needful in starting a happy home.

Having selected a pretty place, build for comfort and convenience. Farm houses should be the prettiest and best. No people spend more of their time at home than the farmers. Farm houses are not generally near each other, and many of the comforts of social life must be provided for by each separate home. Plenty

of room is important. You and yours must look to this building as your ideal for many long years. So build with taste. In the city constant variety and continual new designs in architecture attract, delight and relieve the eye; but you are building a home which must furnish its own delights. Build attractive houses on the farm.

A BEAUTIFUL HOME.
EVERY FARMER CAN AND SHOULD HAVE ONE.

If you are not comfortable at home, you will live an uncomfortable life. Have an eye to comfort, then, in every detail of your home. This is tenfold more important for the farmers' wives. Here in this house will be spent the larger part of their lives. The multifarious little duties of the housewife will make life worse than a drudgery to her if she has few or no conveniences; but if her wants have been anticipated and her comforts provided for, a thousand of her toils can be

lightened. She will be cheerful and happy. Her voice will be full of the music of content. Her home will be bright. Her children will grow up with good hearts and cheery dispositions. Money can not be spent better than in building a good home on the farm. Such a home is educative, mentally and morally. Of course

b *a*

A FARM BARN.
a—The barn with which he started.
b—Shows how farming pays.

you must build according to your ability. Beauty of location does not depend upon that, but size and style of the house do somewhat. If you can only build one or two rooms, build so that you can add to it. A very small house may be a pretty and convenient house. Having this much settled, build neat surroundings. Have an eye to looks, convenience, safety and durability. Do not build as though you expected

to move in a year or two, but as if you expected to live and die right there.

How many and what kind of farm houses each farmer will need, can not be fully discussed here. They will vary as the kind of farming he follows varies.

Next to the dwelling, every farm must have a barn. Many have seemed to give more importance to the barn than to the dwelling. This is wrong. But a good, convenient barn is a necessary part of any well equipped farm. If the farm animals and the produce are to be kept in the same building, it should be a large one. Plenty of room is one step to success. In the South barns need not be expensive. We do not need to build to defend the animals against cold. It is rather for shelter and storage. The arrangements should always have special reference to the convenience of feeding and possibility of escape from fire. The animals should be kept on the ground floor, unless we arrange for manure storage there. Hillsides often help to secure this. Saving manure is second only in importance to storing the feed. Whether to build one very large barn or two or more smaller ones, will often depend upon local surroundings. Every farmer should arrange to keep plenty of animals. Hence he must store much feed, and consequently he must care for much manure.

The manure shed may be a separate place, and the manure be carried from the barn every day. The barn should not be too near the dwelling, so as to be offensive, nor so far away as to be troublesome to reach. If practicable, the barn should always be so

located that the water from the barn and barnyard can be caught in a field, in grass or in cultivation. Much may be saved in this way. Such fields will soon become very rich.

Plenty of houses for storing all farm machinery and tools should be at hand. It does not pay to buy good tools and leave them to the action of sunshine, rain and frost. A little night work spent in planning, and the odds and ends of time with saw and hammer, will usually enable farmers to build most of such houses at very little cost. Every dollar judiciously spent in farm buildings becomes part of the permanent value of the farm. In the South lumber is so cheap and labor so abundant that an industrious man can soon have good houses, and plenty of them.

We once visited a contented, prosperous farmer who had every needed building—twenty-one of them—all built by himself and sons with axe, saw and hammer, and not one of them was a carpenter. He had not paid out twenty-five dollars on the whole. They were neat and well arranged. Of course, every house should be kept neatly painted; paint is cheaper than repair or rebuilding. It can be bought ready prepared, and can be spread on by any one.

So far we have spoken of the farmer's house—the landowner's dwelling place—but the tenant system is so well spread in the South that we must say something of houses for tenants. These are much more numerous in all this country than the others. Their character is distinct, and enters quite largely into the farming economy of the South.

Negroes are contented with such huts, mere apologies for houses, and happy with such meagre surroundings, that decent white people can never successfully compete with them at this point. Such numbers of them will huddle together in one or two rooms of any tumble-down hut, that they defy competition here also.

A NEAT COTTAGE.

Poverty and complete change of labor systems have contributed to discourage building better tenements. Hence we see all grades and conditions of houses as tenements.

They are a disgrace to the land. But in the lapse of years many communities have improved. Landowners have concluded that better houses would help to make better tenants, and better tenants have demanded better houses.

The prevailing style of tenant house is one with two rooms, and a chimney with two fireplaces between. These are often planked up and down and stripped. Very many are now weatherboarded in regular style, and some of them are painted and have glass windows. Farmers have been rather slow to appreciate the effect of these better houses in causing the tenants to remain for longer periods on the same farm. The habit of frequent changes is very hurtful to successful farming. Anything that locates the laborer permanently is a great help.

We unhesitatingly urge that more attention be given to building good, comfortable houses for our laboring people. Houses are a very important item in farm economy. Good houses and attractive surroundings will help to give permanency to our farming population, and in many ways to improve Southern farming.

QUESTIONS.

1. What of the farm home? 2. Is location important? 3. Why is beauty the first point? 4. How should houses be built? 5. Why do we need room and taste? 6. On whose account should comfort and convenience prevail? 7. What will result? 8. What if your means are limited? 9 What is next to the dwelling? 10. What kind of barn? 11. How should it be located? 12. Do we need shelters for the tools? 13. Is there any money lost in good buildings? 14. Need they cost much? 15 Give examples? 16. Shall we paint? 17. What other houses do we need? 18. Why have tenant houses been poor? 19. Are they improving? 20. What style prevails? 21 Conclusions.

CHAPTER XXXIII.

VILLAGE FARMING.

Several times we have alluded to the lonesomeness of farm life. Each farm being a realm of its own, each farm queen has to endure the solitude of her isolation. The situation has grown more painful as farm owners have moved to town and left the country to tenants. Often it becomes unbearable, and another family is driven from the farm to seek society. Very many suggestions have been made to relieve this difficulty. All of these have some merit. None are complete. Among these suggested remedies, village farming deserves particular attention. It proposes that a few thousand acres shall be owned by one party or company, so as to come under one general plan. Near the center a village is to be planned in such way as that a continuation of the streets will reach every part of the farming interests. This village is to be of such size as to furnish all the conveniences of Christian social life. Churches, schools, stores, shops, warehouses and such manufacturing facilities as are needed are provided. Around these dwellings, lots of suitable size are offered. With each of these a large plot of land further out is arranged for. The idea is that each farmer shall live in the village, and thus enjoy social, educational, and commercial privileges. At the same time his farm will be near enough to hand so that, with very little loss of

time, he can come and go. This is a community without any communism.

In this way it is expected that each farmer, following the bent of his individual tastes and capabilities, will produce what he prefers. Thus the greatest possible diversity will be found to be encouraged. The non-producing population will furnish a partial market for the products of the farms. Each man will be as independent as if he lived upon an isolated farm, and yet each will feel the quickening influence of association and competition. These villages will produce much for shipment. In this lies one of their strong points. Shipping in small quantities is often unprofitable, when shipping the same articles in large quantities pays a good profit. In such cases it is easy to secure the co-operation of a large number of all the village farmers. To illustrate: Shipping a few crates of strawberries might not pay, while shipping in car-lots would. The same might be true of grapes, peaches, melons, and vegetables.

The principle of the power of combination and co-operation here has a fair chance. Thus it is claimed that farming might be made more pleasant and profitable by getting the farmers together in these villages. It is also claimed that many who will not farm if compelled to endure the loneliness of solitary farms would be eager to farm with the social advantages thus given; that the congested population of many of our cities would be pleased to find relief in the new phase of farm life. This seems likely. It is further expected that the constant stimulus of social and educational contact

would give better training to those engaged in farming. Clubs for discussion could be organized and kept alive. The mail facilities would help the farmers to take and read very many more journals and books on Agriculture. Lectures and experiments could be easily arranged, and in very many ways the farmers could be educated to better methods than are practicable under the present system.

In older countries these farm villages are quite common. They give protection to the wives and the families of the farmers. There are serious difficulties in getting them started. But few men own tracts large enough. When they do, they are not generally men suited to inaugurate such enterprises, or inclined to do so, if capable. It is difficult to overcome the spirit of individual independence which American influences have instilled into our heads and hearts. The feeling of mutual dependence must precede any hearty unity of purpose and co-operation in practice.

QUESTIONS.

1. What is the situation of most farms? 2. What remedy is proposed? 3. What is village farming? 4. Where are the farms? 5. Where are the homes? 6. What is the idea suggested? 7. What will result? 8. What of the non-producers? 9. What advantage to each farmer? 10. What about surplus? 11. Give illustrations. 12. What is claimed? 13. What else? 14. What other helps? 15. Are they new? 16. What difficulties? 17. Can they be overcome?

CHAPTER XXXIV.

FORESTRY.

Growing the native trees has not been considered farming. The farmer has been compelled to spend large money and labor to get the forest trees destroyed so that he could cultivate the land. No thought was given to the value of the woodland to the farm, until it was seen that the ax was fast helping to produce a desert waste. It was found that, when great stretches of contiguous land were cleared, the winds came with such force as to do much damage. They caused the soil to bake, and hence to need more rain. They gave us colder winters and disastrous storms.. We have come to think that clearing land has been overdone. The system of farming adopted by our ancestors was based upon the idea that it was best to cut down and burn up the forest growth, wear and wash away fields, and clear new ones. Thus they went rapidly forward, never stopping to care for the fields already wearing. We may consider this subject under three points of view.

The era of desolation comes first. This, we have seen, was brought about by want of forethought, and and the settlers were the more encouraged in it by the seemingly exhaustless forests yet ahead of them. When they had desolated one farm, they simply moved further west and found plenty more. Now we must

A PLUM TREE.

call a halt. The supply is not exhaustless. We have reached the boundary and begun to roll back. When we look upon this condition, we are forced to stop and begin the era of contemplation. Amazed at the ruin

AN OAK TREE.

they have wrought, and brought face to face with the fatal consequences about to follow, we must think. What have they done? How did they do it? What shall we do? How shall we do it?

We have greatly injured the farm lands by clearing too fast, and not caring for what was cleared. We need more trees to give us more shade, to break the wind

currents, to cause heavier dews, to prevent washing, and perhaps to increase the rainfall. We must usher in the era of restoration by ceasing to cut down carelessly what remains. Every farmer should study carefully the timber resources and forests on his farm.

POPLAR TREES.

No trees should be cut without good reason. You can use as fuel all defective and dying trees. Where the destruction has gone too far, you can encourage the growth of trees by keeping fires out of the woodland, letting pine orchards grow, and if need be plant such nut-bearing and timber-producing trees as will prove valuable in the future. In this way very much can be done, in a short time, toward providing an abundant forest growth to supply future needs.

In cutting timber for sale a little care in leaving all the small trees to grow will pay a big dividend in the near future. Of course, there are places where this advice would not be considered worth obeying. The habitants of the mountains on the one hand, and of

the pine sections on the other, will think these are idle words, but those of the great hill and plain sections will see the need of them.

Pecans, black walnuts, hickory nuts, chestnuts, oak and pine can be saved or grown with a little care. Fortunately, in many parts of the South, all that is necessary is to give the trees a chance, and they will grow in rich abundance.

QUESTIONS.

1. What has been the idea and practice? 2. What do we begin to see? 3. What was the policy of our fathers? 4. How has it resulted? 5. What point do we first consider? 6 What did they do? 7 How do we feel about it? 8. What is the second era? 9. What do we ask? 10. Why do we need trees? 11. What is the third era? 12. How shall we reason? 13. Can this bring success? 14. Does this apply elsewhere?

CHAPTER XXXV.

THE FARMER AS A CITIZEN.

Socially, politically, and in every relation the farmer is entitled to equal standing with men of any and every profession. As all other pursuits depend ultimately upon his for prosperity, his should be of equal dignity. In this new and growing country the educated young men have largely gone into the professions, as they have been called. The very nature of their work has caused them to study, read and discuss the problems of their business and State. The farmer has been more to himself, and less called upon to keep up with the current events, so he has gradually fallen into the habit of being left out of politics to some extent. Farmers have always been fully recognized as voters, because they are numerous, but as office-holders, as incumbents of places of honor and trust, they have been in a small minority.

This has been a great country for oratory, and orators have largely ruled the country. But as farmers are the great body of our people, they should have a majority of the offices. The very nature of their calling makes them thoughtful, independent, and conservative—safe men in counsel and action. They are largely to blame for the fact that they do not have full voice in everything. They have not claimed their share, neither have they fitted themselves for the full discharge of all the duties of citizenship. Every American citizen is born into politics.

The genius of our government does not excuse him because he pursues this or that vocation. He is part of the government. His duty is to prepare himself to be a good and useful part. He can not excuse himself from helping to rule. No set or class of men have a deeper interest in good government than the farmers. They are the owners of the land. Hence farmers should hold a full share of the offices, and be deeply concerned about those who hold the rest.

Most of the political evils we suffer are directly traceable to carelessness at the primaries and at the ballot boxes. Lawyers have so largely predominated in our lawmaking bodies, and have so completely monopolized the direction of lawmaking, that now we are almost entirely governed by lawyers' laws. With purely patriotic intentions, perhaps, they have devised what seemed best to them; but we all know that they have so multiplied and mystified the laws that it is utterly impossible for the average citizen to know them. Even the lawyers themselves do not know them. As one of them aptly said, "Owing to the glorious uncertainty of the law, I may gain my case." From the school board up to the United States Senate, the farmers should fill their full share of offices, and see that legislation is fair to all, and that laws are executed with evenhanded justice to all.

QUESTIONS.

1. How should the farmer rank as a citizen? 2. Why does he not do so? 3. What has largely ruled? 4. What should be the case? 5. Who is to blame? 6. What is every American? 7. Why should farmers hold office? 8. Who have made our laws? 9. What has resulted? 10. Have we simple laws? 11. What should farmers do?

CHAPTER XXXVI.

THE FARMER SHOULD BE EDUCATED.

In proportion to their numbers, there are fewer educated men among our farmers than in almost any calling. This has come from the idea that a man can make a successful farmer without education, but it was thought that, to succeed in other professions, a man must be educated. From this error it was an easy step to the idea that all other professions were more desirable, and hence more honorable. Our boys grew up thinking they would be more respected, and think more of themselves, if they could be clerks, merchants, doctors, lawyers, ministers, teachers, or railroad men. They preferred anything in the shade to work in the sun. The growing condition of the new country provided very many of the desirable places, so it came about that very few educated young men remained on the farms. The land was new, and labor was rewarded with good crops, even without skill. Almost any man who would work, could make some money on the farm. Education was not called

for. Then came African slavery. Soon this was all massed in the South. Cotton grew easily, and sold well. Negroes did the same. Fortunes were built up as if by magic, and Southern landowners lived like land lords indeed. Then came freedom to the slave, and

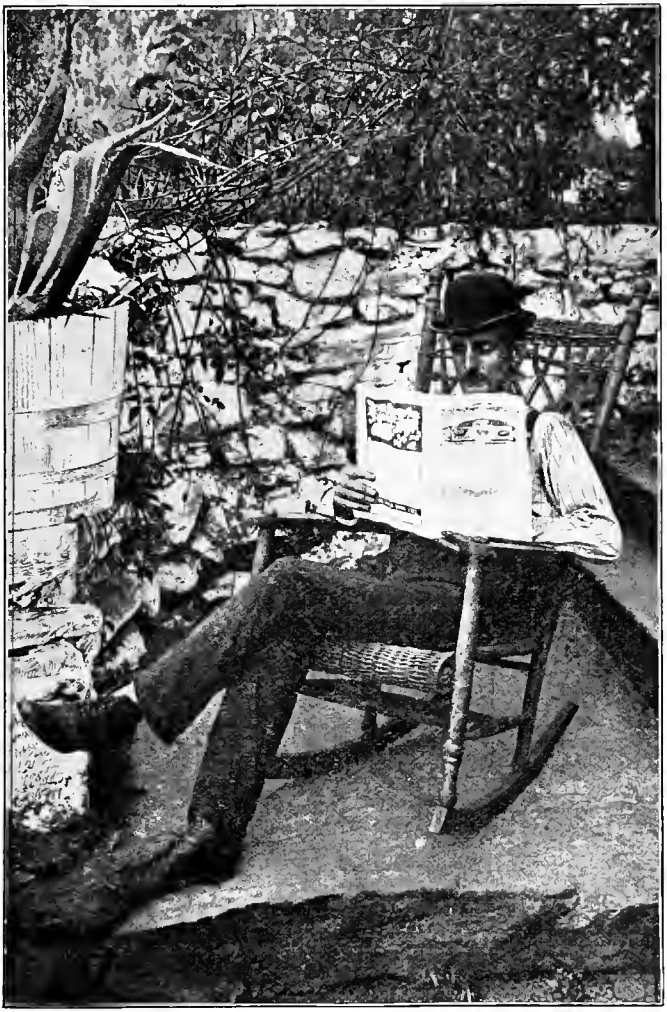
FINE COLLEGE BUILDING.—EVERY FARMER SHOULD ATTEND A COLLEGE.

ruin to his master. It was a mighty upheaval—a labor revolution—a clean wipe-out, and a new start. Things were reversed. The negro could labor in the field, naught else was he fit for. He could grow cotton. It was about all he could do. The white man could labor in the field also, but he did not want to. The freedman was not a congenial companion. So the white man went to other pursuits, and left the negro

to grow cotton, until he has brought us to the border of financial ruin. While this has been going on thirty-odd years, the land has been neglected, and has been washed, worn, and exhausted. This state of things can not continue. A new era must dawn upon us. Better methods must be adopted. Brain must come back to the farm. Science must take the reins. Intelligence must direct. Science has turned on the light. Inventions have multiplied.

Farming is not what it was a generation ago. The virgin soil has largely given place to the old fields. Our energies must now be largely directed to the renovation of old lands. Attention must be given to preserving them, when restored to fertility. Manures, guanos, chemical plant foods, have come to stay, and we must know something of their nature and their use.

New and improved farm machinery of all conceivable kinds enables one man to do the work formerly done by many. These machines do better work than could be done before; but skill is required to use them and keep all their adjustments right. Farming no longer means growing cotton, corn and wheat. A great variety of crops now demands our attention. Diversity is the rule. These crops require study and intelligence. Special lines of farming will rapidly come to the front. We can not specialize without properly understanding our specialty. Our markets are changing. Railroads, telegraphic communication, steamships, electric appliances of all sorts have brought the very "ends of the earth" together. We must know, or we can not keep



THE WAY FOR THE FARMER TO KEEP UP.

up. We must be educated to keep abreast of the times in which we live. Not only does outside pressure drive us to this point, but we must be educated to keep up with the sharp competition among ourselves. If we go on in the old slow, out-of-date way, and our neighbor takes the new and progressive path and gets ahead of us, it is our fault. So that, as the number of educated farmers increases, the necessity for a still greater number grows. As in a syphon, the surrounding pressure is aided by the vacuum created therein. The time has come when the farmer who wishes to succeed must not only know that a piece of work must be done, but how it must be done, and why it must be done. He must know, not guess. He must inquire into the secrets of biology and chemistry, of botany and physics, of geology and astronomy, of mathematics and English. He needs to be a scholar as well as an experimenter. Very often he must be his own physician, before he can reach one. Many times he must act the part of both judge and jury, after pleading the case for both plaintiff and defendant. He can scarcely proceed without a fair knowledge of mechanics and of steam. Machinery he must have and use, and know how to adjust and repair. He must trade so often that he must be a good judge of horses and cows. He needs the broad culture of a well trained brain and the useful skill of an expert hand. No other calling demands so much and such varied knowledge as farming. A knowledge of soils, plants and subsoils, of things and men, will be found useful. It requires more brain to run successfully a six-horse farm than

it does to run a bank or a railroad. Let the farmer boy be educated, full up, all around. When we get our farms managed by educated men, we will rise to the full dignity of our profession. Then, as the peers of any, we will be respected and consulted by all. Then, being not only the bone and sinew of the land, but the brain and power also, we will be accorded the rank our profession deserves. Brain rules the world. Brain directs muscle. Let farmers carry their full share of brain, and they will stand among the counselors of the nation. While they need general, liberal education, they especially need technical education. They should be taught the science of organizing the inorganic, of giving living form to that which is dead, how to use the soil to help the plant grow, how to train the plant to get its food from the soil. Knowledge is power, and an educated brain is a mighty engine. Art is second nature, and working in unison with nature is a useful art. A trained hand is a lever that moves things, but when the educated brain and the trained hand are found in the same man, the steam is up, and the track is ready, and the throttle is waiting to be opened that the great engine may bound away on the course of usefulness.

These make the full man.

QUESTIONS.

1. Have farmers been educated? 2. Why? 3. What have our boys thought? 4. Why was this? 5. What institution helped this? 6. What became of it? 7. What did freedom do? 8. What has resulted? 9. Can we stand this? 10. What must rule? 11. What requires our energy? 12. What else has come into farm life? 13. Can

machinery be operated to advantage by an unskillful person? 14. Why must the farmer be skilled? 15. Upon whom rests the blame if he is not? 16. What is essential to success? 17. Is a knowledge of the sciences necessary? 18 Why? 19. What range of knowledge does he need? 20. What will it do for him? 21. Where will it place him? 22. What special education does he need? 23. What does this enable him to do? 24. Where do we find the full man?

APPENDIX.

In this appendix we give a number of tables, compiled from various sources. They contain much useful information, and should be memorized by the student or farmer.

COMPOSITION OF MANURES.

TABLE I.

Nitrogenous Manures.

ARTICLE	POUNDS PER HUNDRED		
	Nitrogen	Phosphoric Acid	Potash
Sodium nitrate	15½ to 16		
Ammonium sulphate	19 to 20½		
Dried blood, high-grade	12 to 14		
Dried blood, low-grade	10 to 11	3 to 5	
Concentrated tankage	11 to 12½	1 to 2	
Tankage, bone	5 to 6	11 to 14	
Dried fish scrap	7 to 9	6 to 8	
Cotton-seed meal	6½ to 7½	1½ to 2	2 to 3

TABLE II.

Phosphatic Manures.

ARTICLE	POUNDS PER HUNDRED			
	PHOSPHORIC ACID			Nitrogen
	Available	Insoluble	Total	
S. C. phosphate rock		26 to 28	26 to 28	
Florida phosphate rock		33 to 35	33 to 35	
S. C. dissolved rock	12 to 15	1 to 3	13 to 16	
Florida dissolved rock	14 to 16	1 to 4	16 to 20	
Ground bone	5 to 8	15 to 17	20 to 25	2½ to 4½
Steamed bone	6 to 9	16 to 20	22 to 29	1½ to 2½
Dissolved bone	13 to 15	2 to 3	15 to 17	2 to 3

COMPOSITION OF MANURES—Continued.

TABLE III.

Potassic Manures.

ARTICLE	POUNDS PER HUNDRED			
	Potash	Phosphoric Acid	Lime	Chlorine
Muriate of potash	50			45 to 48
Sulphate of potash	48 to 52			½ to 1½
Kainit	12 to 12½			30 to 32
Sylvanit	16 to 20			42 to 46
Cotton-seed hull ashes	20 to 30	7 to 9	10	
Wood ashes, unleached	2 to 8	1 to 2	30 to 35	
Wood ashes, leached	1 to 2	1 to 1½	35 to 40	
Tobacco stems	5 to 8	3 to 5	3½	

TABLE IV.

Average Composition of Farm Manures.

ARTICLE	POUNDS PER HUNDRED				
	Moisture	Nitrogen	Phosphoric Acid	Potash	Lime
Cow manure, fresh	85.3	0.38	0.16	0.36	0.31
Horse manure	71.3	0.53	0.28	0.53	0.21
Sheep manure	64.6	0.83	0.23	0.67	0 33
Hog manure	72.4	0.45	0.19	0 60	0 08
Hen dung	56.0	1.63	0 54	0.85	0 24
Mixed stable manure	75.0	0.50	0.26	0.63	0.70

STOCK FOODS.

TABLE V.

Average Composition of Stock Foods.

NAME OF FOOD	POUNDS PER HUNDRED					
	Water	Crude Protein	Crude Fat	Nitrogen-Free Extract	Crude Fiber	Crude Ash
Green Food and Ensilage:						
Corn fodder	79.3	1.8	0.5	12.2	5.0	1.2
Sorghum fodder	69.4	1.6	1.6	16.8	8.8	1.8
Rye fodder	76.6	2.6	0.6	6.8	11.6	1.8
Bermuda grass	71.7	2.2	0.9	17.3	5.9	2.0
Kentucky bluegrass	65.1	4.1	1.3	17.6	9.1	2.8
Red clover	70.8	4.4	1.1	13.5	8.1	2.1
Cowpea vines	83.6	2.4	0.4	7.1	4.8	1.7
Corn ensilage	79.1	1.7	0.8	11.0	6.0	1.4
Hay and Other Dry Coarse Fodder:						
Corn stover	40.5	3.8	1.1	31.5	19.7	3.4
Bermuda hay	9.5	8.9	2.5	47.9	25.0	6.2
Timothy hay	13.2	5.9	2.5	45.0	29.0	4.4
Hay of mixed grasses	12.9	10.1	2.6	41.3	27.6	5.5
Clover hay	15.3	12.3	3.3	38.1	24.8	6.2
Cowpea-vine hay	10.7	16.6	2.2	42.9	20.1	7.5
Oat straw	9.2	4.0	2.3	42.4	37.0	5.1
Wheat straw	9.6	3.4	1.3	43.4	38.1	4.2
Root Crops:						
Turnips	90.5	1.1	0.2	6.2	1.2	0.8
Sweet Potatoes	68.4	1.9	0.7	26.8	1.1	1.1
Grain Crops and Other Seed:						
Corn	10.9	10.5	5.4	69.6	2.1	1.5
Oats	11.0	11.8	5.0	59.7	9.5	3.0
Barley	10.9	12.4	1.8	69.8	2.7	2.4
Wheat	10.5	11.9	2.1	71.9	1.8	1.8
Cowpeas	12.2	24.2	1.5	54.4	4.3	3.4
Cotton seed	9.9	19.4	19.5	23.9	22.6	4.7
Mill Products:						
Corn meal	15.0	9.2	3.8	68.7	1.9	1.4
Corn and cob meal	15.1	8.5	3.5	64.8	6.6	1.5
Corn bran	9.1	9.0	5.8	62.1	12.7	1.3
Wheat bran	11.9	15.4	4.0	53.9	9.0	5.8
Wheat middlings	12.1	15.6	4.0	60.4	4.6	3.3
Cotton-seed meal	8.5	43.3	13.5	22.3	5.4	7.0
Cotton-seed hulls	10.5	4.4	2.2	36.9	43.3	2.7

STOCK FOODS—Continued.

TABLE VI.

Per Cent. of Nutrients Digestible in Stock Foods.

NAME OF FOOD	Dry Matter	Digestible Nutrients			
		Protein	Fat	Nitrogen-Free Extract	Fiber
Green Food and Ensilage:					
Corn fodder	66	53	76	74	52
Sorghum fodder	67	46	74	74	59
Rye fodder	74	79	74	71	80
Pasture grass	71	70	63	73	76
Clover	66	67	65	78	53
Cowpea vines	76	74	59	84	57
Corn ensilage	64	52	85	69	62
Hay and Other Dry Coarse Fodder					
Corn stover	60	45	62	61	67
Timothy hay	57	48	57	63	52
Hay of mixed grasses	58	58	48	59	60
Clover hay	61	62	62	69	49
Cowpea-vine hay	59	65	50	71	43
Oat straw	48	30	33	44	54
Wheat straw	43	11	31	38	52
Root Crops:					
Turnips	93	90	98	97	100
Potatoes	85	61	------	90	------
Grain Crops and Other Seed:					
Corn	91	76	86	93	58
Oats	70	78	83	76	20
Barley	86	70	89	92	50
Pea meal	87	83	55	94	26
Cotton seed	66	68	87	50	76
Mill Products:					
Corn meal	88	60	92	93	------
Corn and cob meal	79	52	84	88	45
Wheat bran	61	79	68	69	22
Wheat middlings	79	82	85	85	36
Cotton-seed meal	76	88	93	64	32
Cotton-seed hulls	41	6	79	34	47

STOCK FOODS—Continued.

TABLE VII.

Average of Digestible Nutrients and Fertilizing Constituents in Stock Foods.

NAME OF FOOD	Dry Matter in 100 Pounds.	DIGESTIBLE NUTRIENTS IN 100 POUNDS			FERTILIZING CONSTITUENTS IN 100 POUNDS		
		Protein	Fat	Carbo-hydrates	Nitrogen	Phosphoric Acid	Potash
Green Food and Ensilage:							
Corn fodder	20.7	1.0	0.4	11.6	0.30	0.15	0.30
Sorghum fodder	30.6	0.7	1.2	17.6	0.30	0.09	0.25
Rye fodder	23.4	2.1	0.4	14.1	0.53	0.25	0.70
Kentucky bluegrass	34.9	3.0	0.8	19.8	-----	-----	-----
Red clover	29.2	2.9	0.7	14.8	0.54	0.15	0.40
Cowpea vines	16.4	1.8	0.2	8.7	0.27	0.10	0.30
Corn ensilage	20.9	0.9	0.7	11.3	0.28	0.10	0.37
Hay and Other Dry Coarse Fodder:							
Corn stover	59.5	1.7	0.7	32.4	1.10	0.29	1.40
Timothy hay	86.8	2.8	1.4	43.4	1.00	0.50	1.41
Hay of mixed grasses	87.1	5.9	1.2	40.9	1.40	0.27	1.55
Red clover	84.7	7.6	2.0	38.4	2.00	0.38	2.20
Cowpea-vine hay	89.3	10.8	1.1	39.0	2.66	0.52	1.47
Oat straw	90.8	1.2	0.8	38.6	0.46	0.28	1.77
Wheat straw	90.4	0.4	0.4	36.3	0.60	0.22	0.63
Root Crops:							
Turnips	9.5	1.0	0.2	6.1	0.19	0.09	0.34
Potatoes	31.6	1.2	-----	24.1	0.24	0.08	0.37
Grain and Other Seed:							
Corn	89.1	8.0	4.6	65.9	1.58	0.57	0.37
Oats	89.0	9.2	4.2	47.3	1.65	0.69	0.48
Barley	89.1	8.7	1.6	65.6	1.51	0.79	0.48
Cowpeas	87.8	20.0	0.8	53.2	3.87	0.82	0.99
Cottonseed	90.1	13.2	16.9	29.1	3.10	1.05	1.09
Mill Products:							
Corn meal	85.0	5.5	3.5	63.8	1.58	0.63	0.40
Corn and cob meal	84.9	4.4	2.9	60.0	1.41	0.57	0.47
Wheat bran	88.1	12.2	2.7	39.2	2.67	2.89	1.61
Wheat middlings	87.9	12.8	3.4	53.0	2.63	0.95	0.63
Cotton-seed meal	91.5	38.1	12.6	16.0	6.90	3.00	1.50
Cotton-seed hulls	89.5	0.3	1.7	32.9	0.69	0.25	1.02

STOCK FOODS—Continued.

TABLE VIII.

Pounds of Food Required Per Day for 1,000 Pounds Live Weight.

KIND OF ANIMAL	Total Dry Matter	DIGESTIBLE NUTRIENTS			Nutritive Ratio
		Protein	Fat	Carbohydrates	
Oxen at rest in stall	18	0.7	0.1	8.0	1:11.8
Oxen at moderate work	25	2.0	0.5	11.5	1: 6.5
Fattening cattle	28	2.7	0.6	15.0	1: 6.1
Milch cows	28	2.5	0.5	12.0	1: 5.3
Sheep, wool-growing	20	1.5	0.3	11.0	1: 7.8
Sheep, fattening	29	3.0	0.6	15.0	1: 5.5
Horses, moderate work	22	1.8	0.6	11.0	1: 6.9
Horses, hard work	26	2.5	0.8	13.3	1: 6.0
Swine, fattening	32	4.0	0.5	24.0	1: 6.3
Growing Cattle.					
Age in months. Average live wt. per head Lbs.					
2-3 150	22	4.0	2.0	13.8	1: 4.7
3-6 300	23	3.0	1.0	13.5	1: 5.3
6-12 500	24	2.5	0.6	13.5	1: 6.0
12-18 700	24	2.0	0.4	13.0	1: 7.0
18-24 850	24	1.5	0.3	12.0	1: 8.5

WEIGHTS AND MEASURES.

TABLE IX.

Troy Weight.

24 grains	1 pennyweight.
20 pennyweights	1 ounce.
12 ounces	1 pound.

Apothecaries' Weight.

20 grains	1 scruple.
3 scruples	1 drachm.
8 drachms	1 ounce.
12 ounces	1 pound.

Avoirdupois Weight.

27.34 grains	1 drachm.
16 drachms	1 ounce.
16 ounces	1 pound.

Long Measure.

12 inches	1 foot.
3 feet	1 yard.
5½ yards	1 rod, pole or perch.
40 rods	1 furlong.
8 furlongs	1 statute or land mile
3 miles	1 league.

Square or Land Measure.

144 square inches	1 square foot.
9 square feet	1 square yard.
30¼ square yards	1 square rod.
40 square rods	1 rood.
4 roods	1 acre.
640 acres	1 square mile.

Liquid Measure.

4 gills	1 pint—28.875 cubic inches
2 pints	1 quart—57.75 cubic inches
4 quarts	1 gallon—231 cubic inches
63 gallons	1 hogshead.
2 hogsheads	1 pipe or butt.
2 pipes	1 tun.

WEIGHTS AND MEASURES—Continued.

Dry Measure.

2 pints.....1 quart.
4 quarts.....1 gallon.
2 gallons.....1 peck.
4 pecks.....1 struck bushel.

TABLE X.

The Metric System of Weights and Measures.

Metric Units in English Equivalents:

	Inches.	Feet.	Yards.	Miles.
Centimeter...	0.393685	0.032807	.....	.....
Decimeter...	3.93685	0.328071	0.109357	.....
Meter.....	39.3685	3.28071	1.09357	.....
Decameter...	393.685	32.8071	10.9357	.....
Hectometer..	.....	328.071	109.357	0.0621347
Kilometer...	.....	3280.71	1093.57	0.6213466
Myriameter..	.....	32807.1	10935.7	6.213466

Are—154,988 sq. in., 1,076.4 sq. ft., 119.60 sq. yds., 0.0247 acres.
Hectare—107,640 sq. ft., 11,960 sq. yds., 2.471 acres.
Liter—33.8 fluid ounces, 1.0567 liquid quarts, 0.02838 bushels.
Gram—15.43234 grains, 0.03527 ounces avoir., 0.0022 lbs. avoir.
Kilogram—2.2 lbs. avoir.
Foot—0.3048 meters, 3.048 decimeters, 30.48 centimeters.
Mile—1609.344 meters, 1.609344 Kilometers.
Acre—40.4685 ares, 0.4047 hectares.
Gallon—3.7854 liters.
Pound—0.4536 kilogram, 4.536 hectograms.
Ton (2,000 lbs.)—907.1 kilograms, 0.9071 tonneau.
Bushels—35.237 liters.

TABLE XI.

A Cubic Foot is Equal to

1728 cubic inches.
0.8036 struck bushels of 2150.42 cubic inches.
3.2143 pecks.
7.4805 liquid gallons of 231 cubic inches.
6.4285 dry gallons.
29.922 liquid quarts.
25.714 dry quarts.
59.844 liquid pints.
51.428 dry pints.
0.2667 barrel of three struck bushels.
0.2375 liquid barrel of 31½ gallons.

TABLE XII.

Legal or Customary Weights of a Bushel of Produce.

ARTICLES.	POUNDS.
Apples	48
Apples, dried	24
Beans, castor	60
Beans, white	60
Buckwheat	52
Corn, ear	70
Corn, shelled	56
Onions	57
Peaches	38
Potatoes, Irish	60
Potatoes, sweet	55
Peas	60
Bluegrass Seed	14
Turnips	55
Wheat	60
Ground Peas	28
Cotton Seed	32
Barley	48
Rye	60
Rutabagas	60
Oats	32

TABLE XIII.

Number of Plants per Acre at Different Distances.

DISTANCES.	PLANTS.
2 feet x 2 feet	10,890
2 feet x 3 feet	7,260
2 feet x 4 feet	5,445
2 feet x 5 feet	4,356
2 feet x 6 feet	3,630
3 feet x 3 feet	4,840
3 feet x 4 feet	3,630
3 feet x 5 feet	2,904
3 feet x 6 feet	2,420
4 feet x 4 feet	2,722
4 feet x 5 feet	2,178
4 feet x 6 feet	1,185
5 feet x 5 feet	1,742
5 feet x 6 feet	1,452
6 feet x 6 feet	1,210
6 feet x 8 feet	907
8 feet x 8 feet	680
8 feet x 10 feet	544
10 feet x 10 feet	435
10 feet x 12 feet	363
10 feet x 15 feet	290
10 feet x 18 feet	242
10 feet x 20 feet	217
20 feet x 20 feet	108
20 feet x 30 feet	72
30 feet x 30 feet	48
30 feet x 36 feet	40
40 feet x 40 feet	27
40 feet x 50 feet	21
40 feet x 60 feet	18
50 feet x 50 feet	17

TABLE XIV.

A Few Interesting Facts.

One bushel of wheat contains about 320,000 grains.

One bushel of oats contains about 540,000 grains.

One bushel of cotton seed contains about 125,000 seeds.

Wheat roots will grow in good ground from six to eight feet deep.

Corn roots will grow in good ground from eight to ten feet deep

Clover roots will grow in good ground from ten to twelve feet deep.

Alfalfa roots will grow in good ground from twelve to eighteen feet deep.

Oats will grow in good ground from eight to ten feet deep.

Common grass will grow in good ground three to four feet deep

The following yields per acre have been made, and can be made again:

Corn	255 bushels.
Wheat	80 bushels.
Oats	125 bushels.
Barley	80 bushels.
Buckwheat	75 bushels.
Potatoes	1329 bushels.
Turnips	1200 to 1500 bushels.
Mangels	80 tons.
Timothy	6 tons at a cutting.
Bermuda Grass	6 tons at a cutting.
Red Clover	5½ tons at a cutting.

Georgia Contract Price 55 Cents
Georgia Exchange Price 27 Cents

The prices printed herein is fixed by a state contract, and any deviation therefrom shall be reported to your County School Commissioner or to the State School Commissioner at Atlanta